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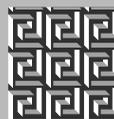
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Word of editor-in-chief

Dear colleagues,

It is our great pleasure and honour to invite you to be our associates – authors and reviewers of scientific and research papers in the *Teaching Innovations* periodical, issued by the University of Belgrade, Teacher Education Faculty. The fact that our periodical has been published more than thirty years, its current rating (categorised as M52 in the list of scientific publications of the Ministry of Education, Science and Technological Development of the Republic of Serbia) and the intention of the editorial board to further improve its rating through the quality of papers show that the periodical *Teaching Innovations* has a long tradition based on the qualities of continuity and actuality, and a potential to continue developing.

The *Teaching Innovations* periodical publishes systematic and original research papers related to sciences and scientific disciplines dealing with the teaching process at all levels of pedagogical and educational work (from pre-school pedagogical work to life-long learning) with the aim of its improvement and modernisation.

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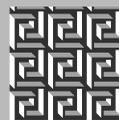
Looking forward to successful cooperation,

Sincerely Yours,

Vera Ž. Radović, PhD,

Editor-in-chief

Иновације у настави



Реч уредника

Поштоване колегинице, поштоване колеге,

Част нам је и задовољство да Вас позовемо да будете наши сарадници – аутори и рецензенти научних и стручних радова у часопису *Иновације у настави*, који издаје Учитељски факултет Универзитета у Београду. Чињеница да је од оснивања часописа протекло више од тридесет година, његов садашњи рејтинг (на листи је научних публикација Министарства просвете, науке и технолошког развоја РС у категорији М52) и настојање уређивачког одбора да квалитетом радова тај рејтинг подигне указују на то да часопис *Иновације у настави* има дугу традицију, да су континуитет и актуелност његови квалитети, а свакако показује како он поседује потенцијал да и у будућности напредује.

У *Иновацијама* објављујемо прегледне и оригиналне истраживачке радове из наука и научних дисциплина које третирају наставни процес на свим нивоима васпитања и образовања (од предшколског васпитања до целоживотног образовања) у циљу његовог унапређења и модернизације.

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Са вером у успешну сарадњу,
Срдачан поздрав,
др Вера Ж. Радовић
главни и одговорни уредник

LEARNING AND DEVELOPMENT THROUGH SOCIAL INTERACTION IN EDUCATIONAL CONTEXT

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УЧЕЊЕ И РАЗВОЈ КРОЗ СОЦИЈАЛНУ ИНТЕРАКЦИЈУ У ОБРАЗОВНОМ КОНТЕКСТУ

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Word of guest editors

The relevance of the topic of this special issue emerges from the fact that from the very beginning of our lives we are part of a social world, thus our overall development and education are situated in a complex network of social relations with people around us and unfold through social interaction with them. Having that in mind, it is not surprising that the field of research of learning and development through social interaction is very rich and miscellaneous. This variety is visible from the perspective of methodological approaches taken by the scholars (qualitative, quantitative or mixed), differences in the types of studied interaction (peer interaction vs. adult-child interaction; symmetrical vs. asymmetrical interaction), focus on different roles within interaction (e.g. parent-child interaction; teacher-student interaction), interest in different aspects of interaction (such as emotional, motivational, cognitive) or what develops within it (e.g. different skills, competencies, knowledge) etc. Based on the analysis of different kinds of research this field Baucal, Arcidiacono and Buđevac (2011)¹ identified two perspectives in studying the social interaction and its role in learning and development – exploratory and analytical perspectives. Within the first, exploratory perspective, the social interaction is not an object of study per se, but it is rather studied in order to explain something that is outside of interaction (e.g. learning of some knowledge within school, development of competencies, self related characteristics, etc.). For example, when one studies the effect of symmetrical peer interaction on development of new cognitive competencies, the focus of such study is on development of new competencies and the social interaction, which has a status of an independent variable. Therefore, the key question in this kind of approach is what is the impact of social interaction on learning and development of some individual characteristics. Within the second, analytical perspective, the social interaction is the main object of research interest and it is analyzed in details in order to describe its diverse patterns and dynamics. The analytical perspective is based on the assumption that different individual characteristics (such as thinking, emotions, competencies, abilities, attitudes, etc.) are relational and situational/contextual by its very “nature”. These traditions of research assume that the study of conversation and interaction between human beings is the main resource for the understanding of the way how different processes (cognitive, emotional, linguistic, social, etc.) are linked within social interaction and create certain kinds of dynamics and trajectories.

¹ Baucal, A., Arcidiacono, F., & Buđevac, N. (2011). Reflecting on different views of social interaction: Explanatory and analytic perspectives. In A. Baucal, F. Arcidiacono & N. Buđevac (Eds.), *Studying interaction in different contexts: A qualitative view* (pp. 233–251). Belgrade: Institute of Psychology.

The goal of this special issue is to present the variety among studies dealing with learning and development through social interaction in terms of conceptual framework, methodologies, object of interaction, context and participants, but all situated within educational context.

The issue is starting with four papers dealing with learning and skills development related to different subjects in elementary school – mathematics (*Buchs et al.; Anić & Pavlović Babić*), science (*Tartas*) and reading (*Buđevac & Baucal*). These papers use a variety of methodological approaches – quantitative, qualitative and mixed. Also, the difference in the focus of these contributions creates the opportunity for the reader to get an insight into the complexity of learning and development of knowledge, skills and competencies through interaction with different tasks and partners as well as by using different tools, to see how different aspects of interaction are interwoven, but also to see what this kind of studies can provide in terms of better understanding of the difficulties which students are facing when learning specific subject contents or appropriate certain skills relevant for learning.

Consequently, the next three contributions present and discuss designs of educational settings through which we can scaffold students learning and development and offer the perspective of involved partners – teachers and parents. Hence, the papers focus on language acquisition in an inclusive educational setting (*Padiglia & Arcidiacono*), inquiry based mathematics learning (*Radišić & Jošić*) and the development of creativity (*Kohler, Boissonnade & Giglio*). These papers provide two relevant findings. Firstly, they demonstrate how specific teaching/learning designs structure and organize learning activities of students by providing opportunities for them to develop some important knowledge and competencies, and secondly, what kind of challenges teachers might be faced with in appropriating and applying a new teaching/learning design in their everyday professional practices.

The next two papers (*Bova; Muller Mirza*) contribute to this special issue by introducing the topic of learning through argumentative discussions in the context of higher education. The authors of these papers remind us on the huge educational potential of argumentative discussions and the way university teachers can use it in order to promote learning of their students. Although focused on the same aspect of learning through the joint work, papers make complementary contributions, taking different methodological approaches.

Finally, the issue is closed by two papers that consider other relevant aspects of this topic – emotional relation between teacher and student as a factor of children learning, as well as attitude toward education and school (*Krstić*), and social interaction as a setting of dynamic assessment of children's abilities (*Nedić, Jošić & Baucal*). Although not primarily focused on learning, these two papers highlight two relevant issues from the perspective of successful learning. One is emotional aspect of teacher-student relation, wherein the author takes the theoretical framework that is very well known in psychology, but not usually considered in the studies of teacher-student relations – attachment theory framework, which additionally increases the value of this contribution. The other perspective starts from a well-known framework – dynamic assessment of children's abilities, but with the focus on one especially vulnerable group of children, namely the children from drop-in centre – and makes the study unique in the Serbian setting.

We believe that this special issue demonstrates the diversity of approaches and methods within the field of learning through social interactions. In our view, it opens the floor for a broad reflection about key open issues, as well as advantages and shortcoming of different methodological approaches. Our main idea is to offer a possibility to open a dialogue with researchers, teachers' trainers, profession-

als involved in the field of education and, of course, teachers that are daily involved in teaching/learning processes from a specific perspective. In fact, they are actors and observers at the same time. Our effort in proposing this special issue is to involve all of them in the analytical processes that the different contributions sustain, in order to cross boundaries between school systems, actors and educational institutions providing guidelines for curricula and teachers' training.

Nevena Budevac
Francesco Arcidiacono
Aleksandar Baucal

Уводна реч њосћујућих уредника

Релевантност теме овог специјалног броја произлази из чињенице да смо од самог почетка свог живота део социјалног света, услед чега су наш целокупан развој и образовање уроњени у сложену мрежу социјалних односа са људима око нас и одвијају се кроз интеракцију са њима. Имајући то на уму, није необично што је област истраживања учења и развоја кроз социјалну интеракцију веома богата и разноврсна. Та разноврсност је видљива са становишта методолошких приступа (квалитативни, квантитативни или комбиновани), различитих типова интеракције који се проучавају (вршњачка интеракција или интеракција између детета и одраслог; симетрична или асиметрична интеракција), усмерености на различите улоге учесника у интеракцији (на пример, интеракција између родитеља и деце или између наставника и ученика), интересовања за различите аспекте интеракције (попут емоционалног, мотивационог, когнитивног) или тога шта се кроз њу развија (на пример, различите вештине, компетенције, знања). На основу анализе истраживања из ове области, Бауцал, Арчидијаконо и Буђевац (2011)¹ идентификовали су два приступа проучавању социјалне интеракције и њене улоге у учењу и развоју – *експлораторну* и *аналитичку*. У оквиру прве, експлораторне перспективе, социјална интеракција није објекат истраживања сама по себи, већ се проучава како би се објаснило нешто изван интеракције (на пример, усвајање школског знања, развој компетенција, особине личности). Тако, рецимо, можемо проучавати ефекте симетричне вршњачке интеракције на развој когнитивних компетенција. Фокус таквог истраживања је на развоју нових компетенција, а социјална интеракција има статус независне варијабле. Према томе, кључно питање у оквиру овог приступа јесте – на који начин социјална интеракција утиче на учење и развој неких индивидуалних карактеристика. У оквиру друге, аналитичке перспективе, социјална интеракција је главни објект интересовања истраживача и анализира се до детаља како би се описали њени различити обрасци и динамика. Аналитичка перспектива се заснива на претпоставци да су различите индивидуалне карактеристике (попут мишљења, емоција, компетенција, способности, ставова и др.) релационе и контекстуализоване. Истраживачки приступи у оквиру ове перспективе, дакле, следе претпоставку да је проучавање конверзације и интеракције између људи главни извор разумевања како су различити процеси (когнитивни, емоционални, лингвистички, социјални и др.) повезани унутар социјалне интеракције и одређују њену динамику.

¹ Baucal, A., Arcidiacono, F., & Buđevac, N. (2011). Reflecting on different views of social interaction: Explanatory and analytic perspectives. In A. Baucal, F. Arcidiacono & N. Buđevac (Eds.), *Studying interaction in different contexts: A qualitative view* (233–251). Belgrade: Institute of Psychology.

Идеја која стоји у основи овог специјалног броја је да се прикаже разноврсност студија које проучавају учење и развој кроз социјалну интеракцију с обзиром на њихов теоријски оквир, методологију, циљ интеракције, учеснике у интеракцији, будући да су све смештене у образовни контекст.

Прва четири рада у овом броју баве се овладавањем знањима из различитих основношколских предмета или развојем вештина од значаја за учење тих предмета. У питању су математика (Букс и сарадници; Анић и Павловић Бабић), природне науке (Тарта) и читање (Буђевац и Бауцал). Ова истраживања се разликују према коришћеној методологији, при чему су заступљене и квантитативна и квалитативна и комбинована методологија. Такође, разлика у фокусу ових радова омогућава читаоцу да стекне увид у сложеност учења и развоја кроз заједнички рад на различитим задацима, да уочи како су различити аспекти интеракције испреплетани, као и да сагледа како нам оваква истраживања могу помоћи да разумемо са каквим се све тешкоћама суочавају ученици када треба да усвоје одређено знање или вештине од значаја за учење.

Број се наставља са три рада која приказују и преиспитују концепције различитих образовних ситуација кроз које можемо да подржавамо учење и развој ученика и уз то пружају увид у то како тај процес изгледа из перспективе укључених актера – наставника и родитеља. Конкретно, радови се баве учењем језика у вишејезичном образовном контексту (Падиља и Арчидијаконо), учењем математике кроз истраживачки рад у настави (Радишић и Јошић) и развојем креативности (Колер, Боасонад и Ђиљо). Кроз ове радове истакнута су два важна налаза. На првом месту, они показују како специфична концепција образовне ситуације структурише и организује активности учења кроз које омогућава ученицима да развију важна знања и компетенције. Такође, ови радови нам говоре о изазовима са којима се наставници могу суочити приликом креирања ових образовних ситуација у свакодневној образовној пракси.

Следећа два рада (Бова; Милер Мирза) доприносе овом специјалном броју кроз увођење теме учења кроз аргументативни дијалог у контексту високог образовања. Аутори ова два рада нас подсећају на образовни потенцијал аргументативног дијалога и на то како професори могу користити овај вид рада како би подстакли учење својих студената. Иако су фокусирани на исти аспект учења кроз заједнички рад, ови радови комплементарно доприносе овом специјалном броју, јер користе различите методолошке приступе.

На крају, издање се завршава радовима који се баве другим важним аспектима теме овог броја – емоционалним аспектом односа ученик-наставник као фактором учења и односа ученика према школи (Крстић) и социјалном интеракцијом као средином за динамичко тестирање дечијих способности (Недић, Јошић и Бауцал). Иако нису примарно фокусирани на учење, ова два рада осветљавају два веома релевантна аспекта успешног учења. Један је емоционални аспект односа ученик-наставник, при чему аутор креће од теоријског оквира који је веома добро познат у психологији, али најчешће није повезан са истраживањима односа између наставника и ученика (теорија афективног везивања), што додатно увећава допринос овог рада. Други рад такође креће од добро познатог теоријског оквира (динамичког тестирања дечијих способности) и фокусира се на једну посебно осетљиву групу деце – децу из Свратишта, што ово истраживање чини јединственим у Србији.

Верујемо да овај специјални број приказује разноврсност у теоријским и методолошким приступима проучавању учења кроз социјалну интеракцију. Из нашег угла, он отвара простор за

размишљање о кључним отвореним питањима из ове области, као и предностима и ограничењима различитих методолошких приступа. Намера нам је била да подстакнемо дијалог између истраживача, затим свих оних који учествују у образовању будућих наставника, бројних стручњака који учествују у образовању, и самих наставника, који су и учесници и посматрачи образовног процеса. Предлагањем овог специјалног броја желели смо, дакле, да иницирамо аналитички процес који ће превазићи појединачне образовне системе, улоге које одређени учесници у њима имају и образовне институције из којих долазе.

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Structured Cooperative Learning as a Means for Improving Average Achievers' Mathematical Learning in Fractions

Abstract: *In primary school, learning fractions is a central mathematical objective. However, the mastery of basic procedures involving fractions presents a difficulty for many students. The aim of the current intervention is to introduce structured cooperative learning as means to improve students' learning, particularly for average achievers. Previous research has underscored that heterogeneous groups might be deleterious for average achievers because they are excluded by the teacher learner relationships that is likely to take place between low and high achievers students. This intervention proposes structuring interactions in order to boost the learning of average achievers in heterogeneous groups. We hypothesize that highly structured cooperative learning should improve average achievers' understanding of the content-targeted in group work as well as progress in terms of fractions learning, when compared to low-structured cooperative learning.*

In this intervention, 108 fifth graders worked cooperatively in heterogeneous triads (a low, average, and high achiever). The triads had to express the length of one segment using three rulers with different sub-units

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and respecting three mathematical skills regarding fractions. Triads were randomly assigned to a low-structured or high-structured cooperative learning condition. In the low-structured condition, no specific structure was provided. (i.e., they organized their cooperative work as they wished). In the high-structured condition, each student became an expert for one part before working in the triad and endorsed different responsibilities.

The results indicated that highly structured cooperative learning favors the understanding of the targeted task, especially for average-ability students. Moreover, students at all levels progressed from the baseline test to the post-test. Indeed, low and high achievers had the same progression in both conditions, whereas average achievers progressed more in the highly structured condition. Results are discussed in terms of new teaching methods that could efficiently increase average achievers' performances.

Key words: Cooperative learning, structure, fraction learning, average achievers, mathematics.

Introduction

In most countries, mathematics is considered one of the most important topics to learn in primary school (Joët, Usher, & Bressoux, 2011; OECD, 2009; Yusof & Malone, 2003). Fractions represent a fundamental cornerstone for the understanding of advanced mathematical concepts, such as algebra, geometry, and statistics (Bailey, Hoard, Nugent, & Geary, 2012). Learning fractions requires deep procedural and conceptual knowledge (Rittle-Johnson & Alibali, 1999) that enables students to thoroughly understand and distinguish between the properties of whole numbers and rational numbers (Ni & Zhou, 2005). Previous work (Siegler et al., 2012) has demonstrated that knowledge of fractions in elementary school predicts competence in general mathematics and algebra in high school.

Despite their undoubted importance in mathematics, fractions remain one of the toughest concepts. The mastery of basic procedures about fractions still represents a difficulty for many students (Carette, Content, Rey, Coché, & Gabriel, 2009; Lin, Wenli, Lin, Su, & Xie, 2014). The National Council of Teachers in Mathematics (Martin & Strutchens, 2007) reported that only 50% of American 8th graders are able to put a series of fractions in the correct order. Furthermore, it seems that the obstacles and deficiencies in fraction knowledge are persistent (Mazzocco & Devlin, 2008). In the present research, we focus in particular on fractions learning among

5th graders of different abilities (low versus average versus high).

To address these difficulties, it is particularly important to design teaching methods and intervention programs that could enhance students' understanding of fractions and tackle low school achievement (e.g., Gabriel, Coché, Szucs, Carette, & Rey, 2012). The aim of the present intervention is to test cooperative learning as a way to improve the understanding and learning of fractions. Moreover, we intended to compare two different forms of cooperative learning—namely, low versus high structured—with respect to the level of students working in heterogeneous teams. Regarding this issue, the prevailing recommendation for the implementation of cooperative learning involves wide range heterogeneous grouping (with high, average, and low achievers in the same group; see Abrami et al., 1995; Sharan, 1999). Nevertheless, research underscores that working in wide-range heterogeneous groups might be problematic for the average students. Indeed, average achievers tend to be less active in this particular group composition (Webb, 1991). It is thus essential to consider a way of maximizing the benefits of cooperative learning in heterogeneous groups for all students. We argue that highly structured cooperative learning might stimulate all students' involvement in wide range grouping and be especially positive for average achievers (Saleh, Lazonder, & de Jong, 2007).

Cooperative Learning

Basic Principles for Cooperative Learning

Cooperative learning is a teaching method in which students work cooperatively in small groups in order to enhance their own and their peers' learning (Abrami, Poulsen & Champer, 2004). A substantial body of research has pointed out the benefits of this practice on students' learning, productivity, social relationships, motivation, and self-esteem (Gillies, in press; Johnson & Johnson, 2009; Johnson, Johnson, Roseth, & Shin, 2014; Slavin, 2014).

Cooperative learning work—compared to unstructured group work—should be organized to ensure its effectiveness (Gillies, 2003, 2007; Johnson, Johnson, & Holubec, 2008). Two principles are essential in all cooperative methods (see Sharan, 1999): positive social interdependence and individual responsibility. Positive social interdependence implies that students' outcomes are affected by their own and others' actions (Johnson & Johnson, 2005). This interdependence can be structured in various ways within a group (Johnson & Johnson, 1989; Johnson, Johnson, & Holubec, 1998). It requires students to work towards a common goal, and they perceive that they can achieve this goal only if all the members of their group attain their individual goals. This positive goal interdependence can be defined in terms of either a joint product or the mastery/learning of all members. Positive interdependence can be reinforced by other dimensions (Johnson, Johnson, & Holubec, 1993), such as sharing complementary resources, being responsible for a delimited part of the task, or endorsing a specific responsibility. Individual responsibility involves each member contributing and being held accountable for his/her own learning and that of others (Johnson et al., 2008; Kagan & Kagan, 2000). Assigning specific roles to team members, identifying each other's contributions, and assessing individual learning are some of the ways that individual responsibility can be increased (Bennett, Rolheiser, & Stevahn, 1991).

Finally, both positive interdependence and individual responsibility favor the development of constructive interactions (Davidson, 1994; Johnson & Johnson, 2009). Students are required to exchange ideas as well as share knowledge and learning strategies (Leikin & Zaslavsky, 1999). They should encourage and teach each other (Battistich, Solomon & Delucchi, 1993), discuss their agreements, and elaborate on their conflicts (Buchs, Butera, Mugny, & Darnon, 2004). These interactive processes favor understanding and learning (Johnson et al., 1998; O'Donnell & King, 1999). Working cooperatively with other peers, students have to verbalize and make visible their knowledge and their reasoning (Mercer, Wegerif, & Dawes, 1999). Based on this, peers are likely to detect what is not understood by their partners and to give understandable explanations (Gillies & Ashman, 1998) that are positively related to gain in sciences understanding (Howe et al., 2007) and performance in mathematics (Webb, 1991). ; Argumentation permits students to reach a shared understanding and favors emergent learning during argumentative talk as well as learning following argumentative interactions (Schwartz, 2009).

Benefits of Cooperative Learning for Mathematics

Over the last few decades, cooperative practices have gained significant grounds in mathematics achievement. Several studies have indicated the superiority of cooperative learning in mathematics over traditional practices—namely, individual work and competition (e.g., Zakaria, Chin, & Daud, 2010). Cooperative learning is linked to positive attitudes toward mathematics and achievement (Zakaria et al., 2010; Tarim & Akdeniz, 2008; Walmsley & Muniz, 2003), problem-solving strategies (Duren & Cherrington, 1992), and fractions learning (Lin, Chen, Lin, Su, & Xie, 2014).

Cooperative learning is supposed to be particularly beneficial for learning mathematics because it supports thinking rather than producing answers, develops multiple representations, accom-

modates different learning styles, and reduces students' anxiety (Bassarear & Davidson, 1992). Leikin and Zaslavsky (1997) pointed out that cooperative settings facilitated students' activeness and mathematical communications (e.g., asking questions, giving explanations, and requesting help). Giving related-content explanations and observing other group members interacting are positively related to mathematic achievement (see Webb, 1991, for a review). Furthermore, receiving elaborated help contributes to the learning of mathematics on the condition that the received explanations are elaborated on and used subsequently in a constructive problem activity (e.g., problem-solving; Webb, Troper, & Fall, 1995).

Importance of Structuring Cooperation in Heterogeneous Groups

The implementation of cooperative learning has been inextricably linked to heterogeneous group composition by a significant number of researchers and manuals (e.g., Davidson, 1990; Abrami et al., 1995; Sharan, 1999). Nevertheless, scholars do not agree on the benefits of heterogeneous grouping (e.g., Lou et al., 1996). Taking into account the interactions that occur in groups can help better understand the effect of group composition (Fuchs, Fuchs, Hamlett, & Karns, 1998). Indeed, empirical evidence suggests that grouping influences the degree to which different achievers (low, average, high) respond and participate within a group (Saleh, Lazonder, & De Jong, 2005; Webb, 1991). For instance, low-ability students perform well in heterogeneous groups in which they have the possibility of interacting with more competent individuals, asking questions, receiving explanations, and filling in the gaps in their knowledge (Lou et al., 1996; Hooper & Hannafin, 1991). As far as students with high ability are concerned, they can benefit from both heterogeneous and homogenous groups (Lou et al., 1996; Saleh et al., 2005). Finally, average-ability students seem to be the least favored in wide range heterogeneous

groups. They tend to stand back, participate less, and are excluded from the peer-tutee relationship that often takes place between high- and low-ability students (Saleh et al., 2005; Webb, 1991).

Interestingly, however, research has shown that average achievers working with only low achievers (low and average students) or with high achievers (average and high students) are more active and perform better compared to when they work in wide-range heterogeneous grouping with low, average, and high students (Hooper, 1992; Webb, 1991). Moreover, Saleh and colleagues (2007) indicated that additional support is needed to strengthen verbal interactions and the learning of average-ability students in wide-range heterogeneous groups. In their study, they provided ground rules for helping to facilitate elaborate explanations in the groups. More importantly, they introduced rules to prevent the same students from initiating all explanations. The objective was to force average achievers to take a more active role in explanations in heterogeneous groups (1 high achiever, 2 average achievers, and 1 low achiever). This structure favored learning for all students and enhanced the motivation as well as the participation of average students.

Thus, taken together, these results suggest that wide-range heterogeneity might be detrimental for students in an intermediate position while activating the peer-tutee interactions between low and high achievers. However, they point to the fact that the intermediate position is not an obstacle *per se*. Indeed, when these students have the opportunity to exchange ideas with their peers (for example, when they only interact with a low- or high-ability partner or when cooperation is highly structured), they can benefit from cooperation. Thus, a crucial question emerges: How can cooperation be organized to make sure each student, including average students, can actively participate in the discussion and benefit from cooperation?

Many researchers have underscored the need to structure carefully cooperative learning (Gillies,

2004, 2008; Webb, 2009) and help students cooperate (Blatchford, Kutnick, Baines, & Galton, 2003; Tolmie et al., 2010) in order to promote constructive interactions. Notably, it is important to establish positive norms for cooperative work and constructive behaviors (Webb, Farivar, & Mastergeorge, 2002) and create conditions for simultaneous interactions that foster contributions from all team members (Kagan & Kagan, 2000). Proposing scripts for interactions (O'Donnell & Dansereau, 1995; Schellens, Van Keer, De Wever, & Valcke, 2007), explicit trainings regarding interpersonal and collaborative skills (Gillies, 2003), or rules for stimulating participation and helping (Saleh et al., 2007) can be effective ways to stimulate interaction and learning. Gillies and Ashman (1995) found that the effect of ability composition is minimal in structured cooperative groups. The present study aims to test whether highly structured cooperative learning can boost average achievers' learning in cooperative groups.

Overview of the Present Research

Considering that fractions remain a major difficulty for pupils in primary school, the first purpose of our intervention was to introduce cooperative learning as a way to favor learning in fractions. We argue that a general cooperative framework can offer a good opportunity for students to increase their mastery of fraction procedures and permit some progress in terms of fraction learning. Thus, in all groups, primary pupils were led to work in triads on a fraction exercise. The instructions involved three cooperative principles: positive interdependence, individual responsibility, and constructive interactions. Indeed, pupils were asked to help each other to master three mathematical skills in order to reach a common answer and to ensure that all the team members understand. They were informed that they would answer an individual learning test after the group work. In the low-structure cooperative learning condition, no additional instruction was provided.

To address the issue of wide heterogeneity in groups (with low, average, and high achievers), another condition was designed. Indeed, starting from the premise that average achievers might be less active in such groups and that taking an active role in giving explanations is a crucial element in mathematics, the highly structured cooperative learning condition intended to ensure that all students in the teams would be engaged in mathematical discussions and group decisions. To that end, positive interdependence was reinforced through resource distribution, complementary expertise, and alternated responsibilities during the exercise. We hypothesized that highly structured cooperative learning should improve all students' understanding and learning of fractions and should be particularly beneficial for average achievers, compared to low-structured cooperative learning.

Method

Participants

One hundred eight 5th graders from seven primary schools participated in this intervention study. Pupils were divided into 36 working groups of three. Preliminary analyses revealed one influential group that could be considered as deviant and, thus, was dropped from the analyses (Cooks' $D > .14$; Snijders & Berkhof, 2008).² The final sample comprised $N = 105$ pupils, embedded in $k = 35$ triads and $l = 9$ classes (49 girls and 56 boys, $M_{age} = 10.66$, $SD = 0.58$).

Procedure

Parental consent was requested, and anonymity was guaranteed. Teachers were present except during group work. The intervention took place over two sessions in pupils' classrooms (see Table 1).

² It should be noted that the hypothesized results remained roughly the same when keeping this influential group—namely, $\chi^2(2, N = 104) = 7.04, p = .029$ for understanding, and $\chi^2(2, N = 104) = 7.04, p = .086$ for learning.

The didactic objective proposed for the group work was derived from a standardized national evaluation on fractions (see, French Ministry of National Education, 2008). The mathematical task involved three skills: 1) understanding fraction reasoning (the addition of a whole number + fraction, the addition of

fractions, the fractional writing); 2) figuring out the equivalence of the writings for different reasonings ($1 + \frac{1}{3}$), ($\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$) and ($1 + \frac{4}{3}$); and 3) being able to use adequate vocabulary. In order to work on fraction notions, we proposed typical exercises used in the national curriculum.

Table 1. Summary of the procedure

Session 1	
Baseline test (9 fraction exercises).	
Lessons and exercises with three mathematical targeted skills:	
<ul style="list-style-type: none"> - explaining the three reasoning - verifying the equivalence of the writing - communicating with appropriate vocabulary 	
Session 2	
General cooperative learning instructions. The three mathematical targeted skills are reminded. A visual support introduced the three social responsibilities	
<i>Pupils worked in heterogeneous triads, randomly assigned to one or the other of the experimental conditions.</i>	
Low-structure condition	High-structure condition
15 min.: Each pupil of the triad worked individually with the three rulers ($\frac{1}{4}$), ($\frac{1}{8}$), ($\frac{1}{16}$).	10 min.: Each pupil of the triad worked individually with one of the three rulers.
10 min.: Pupils worked in triad. They organized the group work as they wished in the respect of the three mathematical skills and the three social responsibilities.	5 min.: pupils were grouped with others who get the same ruler in order to get a common solution (expert groups).
	10 min.: Pupils worked in triad. Each pupil of triad was responsible of one mathematical skill and one social responsibility at time; responsibilities rotated so that all pupils endorsed all skills at one time.
Individual understanding (pupils <i>individually performed a fraction exercise, similar to those carried out in their triads but with a new ruler</i>).	
Standardized post-test measure (9 fractions exercises).	

First session. In the first session, pupils individually performed the baseline test covering the whole notion of fractions. After this test, the experimenter made a lesson on fractions and gave two specific fraction exercises for the pupils to solve collectively. Three relevant mathematical skills identified by the National Mathematics Program (Ministère de l'Éducation Nationale, 2008) were targeted in this exercise: explaining the reasoning, verifying the equivalence of the writing, and communicating with appropriate vocabulary. The lesson allowed the experimenter to provide the exact same amount of information about fractions to all pupils. This included oral explanations and visual supports (displayed on the board during the entire intervention).

Second session. One week later, pupils worked in triads on fraction exercises. In both conditions (low- and high-structure conditions), the experimenter started by reminding the students of the three mathematical skills (explaining reasoning, checking the equivalence of writing, using adequate vocabulary) through visual supports, which remained available throughout the session in the classroom. The experimenter then introduced general cooperative learning instructions for all pupils: She asked pupils to work in triads with a focus on learning and mastery. Pupils were instructed to work cooperatively, taking care of their own learning and their partners' learning. Three social responsibilities were also enhanced: checking that everyone understood; verifying that everybody agreed on the common answer, and reporting the common answer. Pupils reported their consensual answer on the group sheet (positive goal and resource interdependence). They were asked to encourage each other and explain their reasoning (constructive interactions). They were also informed they would complete an individual learning test after the group work (individual responsibility). These cooperative instructions were provided in both conditions.

Pupils were assigned to the different triads according to their performance on the standardized baseline test. Specifically, within each class, each pu-

pil was placed in a heterogeneous triad with one low, one average, and one high achiever. The task consisted of one exercise on fractions adapted from two pedagogical books for 5th grade (Briand, Vergnes, Ngono, & Peltier, 2009; Charnay, Douaire, Valentin, & Guillaume, 2005). These exercises had to be solved in triads and consisted of presenting a segment to pupils. They were asked to use a standard measure in order to express the length of this segment in terms of fractions of a standard measurement.

The standard measure was graduated with different sub-units, respectively representing $\left(\frac{1}{4}\right)$, $\left(\frac{1}{8}\right)$ and $\left(\frac{1}{16}\right)$, which we named "the three rulers." Pupils had to write the length of the segment using as many writings as possible while using adequate vocabulary. They also had to check that all writings were equivalent. They were required to use all rulers to measure the segment. During this phase, the degree of structure varied depending on the conditions: low- versus high-structured cooperation (see Independent Variables).

After the exercise in triads, individuals' understanding was evaluated (see Dependent Variables), and then pupils resolved an individual post-test covering the whole notion of fractions (see Dependent Variables).

Independent Variables

Initial level of achievement. The baseline test consisted of nine fraction exercises extracted from French standardized national assessments and from a previous study (Carette et al., 2009). This baseline test lasted 20 minutes. Theoretically, scores can range from 0 to 20. Depending on their score at the baseline test, pupils were considered low achievers ($M_{pre-test} = 5.23$, $SD = 2.65$), average achievers ($M_{pre-test} = 10.65$, $SD = 3.04$), or high achievers ($M_{pre-test} = 14.94$, $SD = 2.98$).

Structure of cooperation. In each class, half of the pupils were randomly assigned to a low-structure cooperative learning condition, whereas the other half was assigned to a high-structure coopera-

tive learning condition. In the *low-structure condition* ($n = 51$, $k = 17$, $l = 9$), material was distributed to all pupils (i.e., each pupil had the three different rulers $(\frac{1}{4}, \frac{1}{8}, \frac{1}{16})$). Pupils had to apply the three mathematical skills (explaining reasoning, checking the equivalence of writing, and using adequate vocabulary). They individually worked on the exercise for 15 minutes with the three rulers. After this work, they had to discuss their answers in their triads, using all skills and rulers; they had to make sure that everybody understood and then report their consensual answers. They organized their group work however they wished (10 minutes).

In the *high-structure condition* ($n = 54$, $k = 18$, $l = 9$), materials were divided among the pupils in each triad (i.e., one ruler per person), reinforcing the positive resource interdependence. Pupils worked alone with one ruler for 10 minutes. They were then grouped with other pupils with the same ruler (i.e., in “expert groups”) for 5 minutes; they interacted with all the pupils from their session who had received the same ruler as they did. Their goal was to find a common solution. After this expert group work, pupils returned to their original triads and had to explain their acquired skills to their peers. We introduced specific responsibilities based on the targeted mathematical skills and the targeted social responsibilities introduced in the general cooperative framework and we proposed that pupils alternate these responsibilities during the exercise. Thus, when working with the first ruler, one of the pupils was responsible for explaining his/her reasoning (mathematical skills) and for ensuring that everybody understood (social responsibility); the other pupil was responsible for checking writing equivalence (mathematical skills) and that everybody agreed (social responsibility); and the third pupil was responsible for checking that all partners used adequate vocabulary (mathematical skills) and for reporting the common answer on the group sheet (social responsibility). For the second and third rulers, responsibilities were rotated so that each pupil was required

to endorse all responsibilities at one time. In order to help pupils organize their responsibilities, they could rely on a summary card (see Appendixes A, B, and C). Each card contained the visual support for mathematical skills (those proposed in the collective lesson and displayed on the board in all conditions) and some words to help pupils with social responsibility. This procedure was proposed to reinforce both individual responsibility and positive interdependence.

Dependent Variables

Individual understanding. After the group work, pupils individually performed a similar fraction exercise as those carried out in their triads, but with a new ruler (adapted from Briand et al., 2009; Charnay et al., 2005). In this application exercise, they were asked to measure the length of a segment with a new ruler graduated in $(\frac{1}{5})$. Mean grades could range from 0 to 3 ($M = 1.88$, $SD = 1.29$). Zero points were assigned for a non-answer or a false or incomprehensible answer. One point was allocated for correct answers without using fractions, two points for at least one correct answer using fractions, and three points corresponded to several correct answers using fractions.

Individual progress in fractions learning. Individual progress in fraction learning was measured by assessing the evolution from baseline test to post-test. The baseline test and the post-test covered the whole notion of fractions. They consisted of 9 fraction exercises extracted from standardized national assessments and from a previous study (Carette et al., 2009). The two tests were the same except that all mathematical values were changed. They were corrected by the experimenter, who remained blind to the experimental conditions. The same standardized evaluation matrix was used to compute an individual’s score, theoretically ranging between 0 and 20 (mean scores for baseline $M = 10.31$, $SD = 4.88$; mean scores for post-test $M = 13.52$, $SD = 4.52$; observed mean progress $M = 3.21$, $SD = 3.38$).

Table 2. Coefficients estimating and statistical tests of the multilevel models testing the effect of the initial level of achievement and the structure of cooperation on individual level of understanding (first set of analyses) and learning (second set of analyses).

		First set of analyses: Understanding			Second set of analyses: Learning		
		B	CI	Test	B	CI	Test
Level 1	Intercept, \hat{a}_{000}	1.85	1.50, 2.20	$Z = 10.33^{**}$	3.19	2.60, 3.77	$Z = 10.70^{**}$
	Initial level of achievement (IAch), \hat{a}_{100}	n/a	n/a	$\chi^2 = 44.00^{**}$	n/a	n/a	$\chi^2 = 21.40^{**}$
	Age (A), \hat{a}_{200}	-0.55	-0.88, -0.22	$Z = 3.25^{**}$	-0.97	-2.03, 0.09	$Z = -1.79^\dagger$
Level 2	Structure of cooperation (Coop), \hat{a}_{001}	0.42	0.07, 0.77	$Z = 2.33^*$	0.65	-0.51, 1.82	$Z = 1.10$
Cross-level	Initial level of achievement x structure of cooperation, \hat{a}_{101}	n/a	n/a	$\chi^2 = 7.96^*$	n/a	n/a	$\chi^2 = 6.27^*$
Residuals	Level-1 variance, $\hat{\sigma}_{ijk}$	0.79	0.59, 1.05	n/a	8.76	6.26, 12.26	n/a
	Level-2 variance, $\hat{\sigma}_{0jk}$	0.00	n.s.	n/a	0.01	n.s.	n/a
	Level-3 variance, $\hat{\sigma}_{0k}$	0.21	0.06, 0.78	n/a	0.12	n.s.	n/a

Notes: The formula of each model is $Y_{ijk} = \beta_{000} + \beta_{100} * IAch_{ijk} + \beta_{200} * A_{ijk} + \beta_{001} * Coop_k + \beta_{101} * IAch_{ijk} * Coop_k + \zeta_{0jk} + \zeta_{0k} + \epsilon_{ijk}$; the effects of the initial level of achievement (i.e., a categorical variable with three modalities) were obtained using dummy variables; n/a means "not applicable", and n.s. "non significant"; $** p < .01$, $* p < .05$, $^\dagger p < .1$.

Results

Overview of the Multilevel Regression Analyses

A summary of the results is presented in Table 2. Observations consisted of pupils (i.e., level 1) nested in triads (i.e., level 2) nested in classrooms (i.e., level 3). Given the hierarchical structure of the data, three-level multilevel modeling was employed (Rabe-Hesketh & Skrondal, 2012). Specifically, a first set of multilevel regression analyses was performed using individuals' understanding as the dependent variable; a second one was conducted using individuals' progress in fraction learning as the dependent variable.³

In each set of analyses, our dependent variable was regressed on three predictors: (i) the initial

level of achievement (i.e., a level 1 categorical variable: low versus average versus high achiever), (ii) the structure of cooperation (i.e., a level 2 dichotomous variable: coded -0.5 for low structure and +0.5 for high structure), and (iii) the cross-level interaction between the two. It is worth noting that, in preliminary analyses, the pupil's age was found to be negatively associated with both individual understanding and learning (cf. Table 1). Hence, grand-mean centered age (i.e., a level 1 continuous variable) was always statistically controlled.

Initial level of achievement, structure of cooperation, and understanding. First of all, a main effect of the initial level of achievement was found, $\chi^2(2, N = 104^4) = 44.00, p < .001$. Notwithstanding the structure of cooperation, low achievers ($M = 1.15, 95\% \text{ CI } [0.72, 1.58]^5$) obtained a lower score of individual understanding than average achievers ($M = 1.82 [1.38, 2.25]$), who themselves obtained a lower one than high achievers ($M = 2.58 [2.15, 3.00]$).

3 As far as individuals' understanding is concerned, intraclass correlation did not differ from zero to level 2, indicating that the variance of understanding was not due to between-triad differences, and was $\rho = .15$ at level 3, indicating that 15% of the variance of understanding was due to between-class differences. As far as the learning is concerned, intraclass correlation did not differ from zero to level 2 and was $\rho = .09$ at level 3. However, as recommended by Barr, Levy, Scheepers, and Tily (2013), all random intercepts were included in the final model.

4 The sample size is $N = 104$ (rather than $N = 105$) because of one missing value on our dependent variable.

5 From here on, the 95% CI is omitted. Hence, all square brackets signal a 95% confidence interval.

Second, a main effect of the structure of cooperation was observed, $B = 0.41$, $[0.07, 0.77]$, $Z = 2.33$, $p = .02$. Compared with the pupils in the low-structure cooperation condition ($M = 1.64$ $[1.25, 2.04]$), the pupils in the high-structure cooperation condition ($M = 2.06$ $[1.67, 2.45]$) gave an average of 0.41 (out of three) more correct responses. In other words, higher structure was beneficial for all pupils' understanding, regardless of their initial level of achievement.

Third and more importantly, analyses revealed a cross-level interaction effect between the initial level of achievement and the structure of cooperation, $\chi^2(2, N = 104) = 7.96$, $p = .019$. In other words, depending on the initial level of achievement, the effects of the structure of cooperation were not the same. Average achievers benefitted the most from structured cooperative learning, $B = 1.11$ $[0.51, 1.72]$, $Z = 3.62$, $p < .001$. Average achievers in the high-structure cooperation condition ($M = 2.38$ $[1.85, 2.90]$) gave an average of 1.11 (out of three) more correct responses than those in the low-structure cooperation condition ($M = 1.26$ $[0.73, 1.80]$). However, the effect of the structure of cooperation was significant for neither low achievers, $B = 0.01$ $[-0.59, 0.60]$, $Z < 1$, *n.s.*, nor high achievers, $B = 0.13$, $[-0.48, 0.73]$, $Z < 1$, *n.s.* These results indicated that low achievers did not provide more correct answers when cooperation was highly structured ($M = 1.15$ $[0.63, 1.68]$) than when it was not ($M = 1.16$ $[0.63-1.68]$). Similarly, for high achievers, no differences were observed between the low-structure cooperation condition ($M = 2.51$ $[1.98, 3.04]$) and the high-structure one ($M = 2.64$ $[2.12, 3.15]$). In sum, in line with our hypothesis, and as can be seen in Figure 1, structuring cooperation was particularly beneficial for average achievers' understanding, relative to low and high achievers.

Initial level of achievement, structure of cooperation, and individual progress in fractions learning. As far as the second set of analyses is concerned, we aimed to test our hypothesis using pro-

gress in learning as a dependent variable. Hence, we subtracted the performance on the baseline test from that on the post-test; the more positive the computed variable, the higher the improvement. Progress was then regressed on the same predictors as before—namely, (i) the initial level of achievement, (ii) the structure of cooperation, (iii) the cross-level interaction between the two, and (iv) age.

First, the intercept was significantly different from zero, $B = 3.18$, $[2.60, 3.76]$, $Z = 10.70$, $p < .001$. Irrespective of both the condition or the initial level of achievement, it pertained to the fact that pupils progressed an average of 3.18 points (of 20) from the baseline test ($M = 10.27$ $[8.89, 11.65]$) to the post-test ($M = 13.45$ $[12.87, 14.04]$).

Second, a main effect of the initial level of achievement was found, $\chi^2(2, N = 104) = 21.40$, $p < .001$. This result indicated that, overall, low achievers made more baseline-to-post-test progress ($B = 5.12$ $[4.11, 6.14]$) than average achievers ($B = 2.45$ $[1.44, 3.47]$), who themselves made more progress than high achievers ($B = 1.98$ $[0.97, 2.98]$). Such a finding might simply reflect that lower achievers have greater room for improvement (due to starting from a lower level). Hence, mechanically, the lower the initial achievement, the stronger the effects of cooperation—be it poorly or highly structured—on improvement.

Finally, an interaction effect between the initial level of achievement and structure of cooperation was once again observed, $\chi^2(2, N = 104) = 6.27$, $p = .044$. Simply put, as a function of the initial level of achievement, the effect of the structure of cooperation was different. As far as average achievers are concerned, the structure of cooperation predicted a progress of 2.64 extra points, $B = 2.64$ $[0.66, 4.62]$, $Z = 2.61$, $p = .009$. Indeed, from the baseline to the post-test, the average achievers in the low-structure condition progressed by $B = 1.14$ $[-0.29, 2.56]$ points, whereas in the high-structure condi-

6 Once again, there was one missing value on our dependent variable; it is not the same participant as before.

tion, they progressed by $B = 3.77$ [2.37, 5.18] points. However, the structure of cooperation did not predict differences in terms of progress for low achievers $B = -0.79$ [-2.77, 1.19], $Z < 1$, *n.s.* It indicated that low achievers progressed the same when cooperation was highly structured ($B = 4.73$ [3.32, 6.14]) or not ($B = 5.52$ [4.09, 6.94]). Furthermore, the structure of cooperation did not predict progress for high achievers, $B = 0.11$, [-1.92, 2.15], $Z < 1$, *n.s.* In other words, once again no differences were observed between the low- ($M = 1.92$ [0.45, 3.39]) and high-structure cooperation conditions ($M = 2.04$ [0.65, 3.42]). In sum, in line with our hypothesis, and as seen in Figure 2, structuring cooperation triggered particular improvements for average (versus low or high) achievers.

Discussion

As mentioned in the introduction, learning fractions remains one of the toughest concepts to learn at school. This paper focused on cooperative learning as a tool to foster learning fractions, especially for average-ability pupils in largely heterogeneous groupings. We argued that, although generally positive for learning, cooperative learning might not be beneficial for intermediate position achievers in heterogeneous groups (low-, average-, and high-ability students). Indeed, these students might suffer from being excluded from the discussion. In the present paper, we argue that structuring cooperation can actively engage each pupil in the group discussion; as such, highly structured cooperative learning might be particularly beneficial for average-ability pupils compared to weakly structured cooperative work. In both conditions, the experimenter introduced cooperative instructions (with positive interdependence, individual responsibility, and constructive interactions). The group work was built around common material (three rulers), mathematical skills (three specific skills), and social responsibilities (three social roles). The main difference be-

tween the two conditions was that, in the low-structured condition, pupils organized their work as they wished whereas, in the high-structure condition, materials were divided among pupils and each of them had to endorse specific responsibilities at different moments in the group work. Thus, the present study tested whether high- and low-structure conditions affect individual understanding and individual progress in terms of fractions learning and whether this impact depends on the pupil's initial level.

First, the results indicated that the high-structured condition increased pupils' understanding more than the low-structured condition. This point is important. Indeed, from a pedagogical perspective, this result sustains that structured cooperative learning is more beneficial for mathematical understanding than unstructured cooperative learning, specifically for fractions learning topic. More importantly, statistical analyses demonstrated that more structure mainly increased the understanding for average achievers but did not affect the understanding of low and high achievers. Thus, highly structured cooperative learning seems to be especially efficient for average achievers' understanding.

Regarding individual progress in fractions learning, positive progression is observed in both low- and high-structured conditions for all pupils. Thus, cooperative learning offers some benefits for mathematical (Zakaria et al., 2010) and fractions learning (Lin et al., 2014). This progression is even stronger when pupils' initial level was low. Moreover, as for the understanding variable, the interaction indicated that more structure increased individuals' progress in learning fractions mainly for average achievers. Once again, the degree of structure did not affect individuals' progress for low and high achievers.

Taken together, these findings underscore that more structure (versus less) appears to be more effective for average achievers than for low or high achievers, who might benefit from cooperation whatever its level of structure. The other important

point underscored by the present study is that the degree of structure has no effect on either the understanding or the progression of low and high achievers.

These findings suggest that a structure that imposes all students to be socially and cognitively engaged during group work is a crucial component that enables average achievers to benefit from cooperation. This appears to be particularly important in elementary school, where teachers are likely to compose heterogeneous groups (Saleh et al., 2005). Our results indicated that building heterogeneous groups in a class requires special attention on average achievers. Indeed, they underscored the benefits of highly structured cooperative learning for average achievers. Although often excluded from social interactions in classic heterogeneous group work (Saleh et al., 2005; Webb, 1991), cooperative structure might be a solution to balance the interactions among group members. As such, this study proposes an interesting pedagogical cooperative learning method that can be used in classrooms to improve the organization of these interactions in heterogeneous work groups.

Our results suggest that participation in constructive social interactions in cooperative heterogeneous groups may be important and that the structure introduced may favor active involvement from all partners in the group. However, in the present study, pupils' actual participation was not directly measured. Future research could integrate video-taping of the different group work efforts to

measure the extent to which average achievers participate in the group discussion more actively in the highly structured cooperative condition than in the low-structured condition.

As previously mentioned, the cooperative learning procedure designed in the present study can be used directly by teachers in their classrooms to develop average achievers' understanding and progress without affecting low and high achievers' performances. It is interesting to note that the present research focused on both individuals' understanding regarding the specific task and generalized progress in learning fractions. However, previous research has documented that the benefits of using that cooperative learning in classrooms can also be observed with other variables. The large body of empirical evidence regarding the contribution of cooperative methods for achievement (Hattie, 2008; Slavin, 2014), self-esteem (Johnson & Johnson, 1989), motivation (Johnson, et al., 2014), and peer relationships (Roseth, Johnson, & Johnson, 2008) means that real value exists in supporting teachers in the implementation of these methods in their daily teaching. Nevertheless, it might be not sufficient to propose that pupils/students merely cooperate; rather, the way the teacher structures social interactions in groups is important to favor all students' learning. Our study proposes a pedagogical cooperative learning method that can be used in classrooms to improve the organization of social interactions in heterogeneous work groups in order to support understanding and learning from all students participate in groups.

References

- Abrami, P. C., Chambers, B., Poulsen, C., De Simone, C., d'Apollonia, S., & Howden, J. (1995). *Classroom connections: Understanding and using cooperative learning*. Toronto: Harcourt-Brace.
- Abrami, P. C., Poulsen, C., & Chambers, B. (2004). Teacher motivation to implement an educational innovation: Factors differentiating users and non-users of cooperative learning. *Educational Psychology*, 24(2), 201-216. <http://dx.doi.org/10.1080/0144341032000160146>

- Bailey, D.H., Hoard, M.K., Nugent, L., & Geary, D.C. (2012). Competence with fractions predicts gains in mathematics achievement. *Journal of Experimental Child Psychology*, 113, 447–455. doi: 10.1016/j.jecp.2012.06.004
- Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, 68, 255-278.
- Bassarear, T., & Davidson, N. (1992). The use of small group learning situations in mathematics instruction as a tool. In N Davidson & T. Worsham (Eds.), *Changing thinking through cooperative learning* (pp. 235-250). New-York: Teachers College Press.
- Battistich, V., Solomon, D., & Delucchi, K. (1993). Interaction processes and student outcomes in cooperative learning groups. *The Elementary School Journal*, 19-32.
- Bennett, B., Rolheiser, C., & Stevahn, L. (1991). *Cooperative learning: Where hearts meets mind*. Ontario: Educational Connections.
- Blatchford, P., Kutnick, P., Baines, E., & Galton, M. (2003). Toward a social pedagogy of classroom group work. *International Journal of Educational Research*, 39(1-2), 153-172.
- Briand, J., Vergnes, D., Ngono, B., & Peltier, M. L. (2009). *Euromaths CM2*. Paris : Hatier.
- Buchs, C., Butera, F., Mugny, G., & Darnon, C. (2004). Conflict elaboration and cognitive outcomes. *Theory Into Practice*, 43(1), 23-30.
- Carette, V., Content, A., Rey, B., Coché, F., & Gabriel, F. (2009). Etude de l'apprentissage des nombres rationnels et des fractions dans une approche par compétences à l'école primaire. *Final report 126/07*. Retrived from <http://www.ulb.ac.be/facs/sse/img/fractions.pdf>.
- Charnay, R., Douaire, J., Valentin, D., & Guillaume, J. C. (2005). *Apprentissage numérique et résolution de problèmes*. Paris : Hatier.
- Davidson, N. (1990). Small-group cooperative learning in mathematics. *Teaching & learning mathematics in the*, 52-61.
- Davidson, N. (1994). Cooperative and collaborative learning: An integrative perspective. In J. S. Thousand, R. A. Villa, & A. I. Nevin (Eds.), *Creativity and collaborative learning: A practical guide to empowering students and teachers* (pp. 13-30). Baltimore: Paul H. Brookes Publishing.
- Duren, P. E., & Cherrington, A. (1992). The Effects of Cooperative Group Work Versus Independent Practice on the Learning of Some Problem-Solving Strategies. *School Science and Mathematics*, 92(2), 80-83. doi: 10.1111/j.1949-8594.1992.tb12146.x
- Fuchs, L. S., Fuchs, D., Hamlett, C. L., & Karns, K. (1998). High-achieving students' interactions and performance on complex mathematical tasks as a function of homogeneous and heterogeneous pairings. *American Educational Research Journal*, 35(2), 227-267.
- Gabriel, F., Coché, F., Szucs, D., Carette, V., & Rey, B. (2012). Developing children's understanding of fractions: an intervention study. *Mind, Brain, and Education*, 6(3), 137-146. doi: 10.1111/j.1751-228X.2012.01149.x
- Gillies, R. M. (2003). Structuring co-operative learning experiences in primary schools. In R. M. Gillies & A. F. Ashman (Eds.), *Co-operative learning: The social and intellectual outcomes of learning in groups* (pp. 35-53). New York, NY: Routledge.

- Gillies, R. M. (2004). The effect of cooperative learning on junior high school students during small group learning. *Learning and Instruction, 14*, 197-213. doi: 10.1016/S0959-4752(03)00068-9
- Gillies, R. M. (2007). *Cooperative learning: Integrating theory and practice*. Thousand Oaks: Sage Publications.
- Gillies, R. M. (2008). The effects of cooperative learning on junior high school students' behaviours, discourse and learning during a science-based learning activity. *School Psychology International, 29*(3), 328-347. doi: 10.1177/0143034308093673
- Gillies, R. M. (Ed.). (2015). *Collaborative learning: developments in research and practice*. Hauppauge, NY: Nova Science.
- Gillies, R. M., & Ashman, A. F. (1995). The effect of gender and ability on students' behaviours and interactions in classroom-based work groups. *British Educational Research Journal, 65*, 211-225.
- Gillies, R. M., & Ashman, A. F. (1998). Behavior and interactions of children in cooperative groups in lower and middle elementary grades. *Journal of Educational Psychology, 90*(4), 746-757. Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.
- Hooper, S. (1992). Effects of peer interaction during computer-based mathematics instruction. *The Journal of Educational Research, 85*(3), 180-189. doi:10.1080/00220671.1992.9944435
- Hooper, S., & Hannafin, M. J. (1991). The effects of group composition on achievement, interaction, and learning efficiency during computer-based cooperative instruction. *Educational Technology Research and Development, 39*(3), 27-40. doi: 10.1007/BF02296436
- Howe, C., Tolmie, A., Thurston, A., Topping, K., Christie, D., Livingston, K., . . . Donaldson, C. (2007). Group work in elementary science: Towards organisational principles for supporting pupil learning. *Learning & Instruction, 17*, 549-563.
- Joët, G., Usher, E. L., & Bressoux, P. (2011). Sources of self-efficacy: An investigation of elementary school students in France. *Journal of Educational Psychology, 103*(3), 649-663.
- Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Interaction Book Company.
- Johnson, D. W., & Johnson, R. T. (2005). New developments in social interdependence theory. *Genetic, Social, and General Psychology Monographs, 131*, 285-358.
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(5), 365-379. doi: 10.3102/0013189X09339057
- Johnson, D. W., Johnson, R. T., & Holubec, E. (1998). *Advanced cooperative learning (3rd edition)*. Minneapolis: Interaction Book Company.
- Johnson, D. W., Johnson, R. T., & Holubec, E. (2008). *Cooperation in the classroom (8th edition)*. Minneapolis: Interaction Book Company.
- Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1993). *Circles of learning: Cooperation in the classroom*. Edina, MN: Interaction Book Company.
- Johnson, D. W., Johnson, R. T., Roseth, C., & Shin, T. S. (2014). The relationship between motivation and achievement in interdependent situations. *Journal of Applied Social Psychology, 44*(9), 622-633.
- Kagan, M., & Kagan, S. (2000). *Advanced cooperative learning*. San Clemente: Kagan.

- Leikin, R., & Zaslavsky, O. (1997). Facilitating student interactions in mathematics in a cooperative learning setting. *Journal for Research in Mathematics Education*, 331-354. doi: 10.2307/749784
- Leikin, R., & Zaslavsky, O. (1999). Cooperative learning in mathematics. *Mathematics Teacher*, 92(3), 240-246.
- Lin, C. P., Wenli, C., Lin, C. C., Su, Y. T., & Xie, W. (2014). Group scribbles to support “fraction” collaborative learning in a primary school. *Research and Practice in Technology Enhanced Learning*, 9(3), 461–473.
- Lou, Y., Abrami, P. C., Spence, J. C., Poulsen, C., Chambers, B., & d'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research*, 66(4), 423-458. doi:10.3102/00346543066004423
- Martin, W. G., & Strutchens, M. E (Eds.) (2007). *The Learning of Mathematics (69th Yearbook)*. Reston, VA: National Council of Teachers of Mathematics.
- Mazzocco, M. M., & Devlin, K. T. (2008). Parts and ‘holes’: Gaps in rational number sense among children with vs. without mathematical learning disabilities. *Developmental Science*, 11(5), 681-691. doi: 10.1111/j.1467-7687.2008.00717.x
- Mercer, N., Wegerif, R., & Dawes, L. (1999). Children’s talk and the development of reasoning in the classroom. *British Educational Research Journal*, 25(1), 95-111. doi: 10.1080/0141192990250107
- Ministère de l'Éducation Nationale. (2008). Horaires et programmes d'enseignement à l'école primaire. *Bulletin Officiel*, 3(19 juin 2008). Retrieved from <http://www.education.gouv.fr/bo/2008/hs3/default.htm>
- Muller Mirza, N., & Perret-Clermont, A.-N. (Eds.). (2009). *Argumentation and education. Theoretical foundations and practices*. New York: Springer.
- Ni, Y., & Zhou, Y.-D. (2005). Teaching and Learning Fraction and Rational Numbers: The Origins and Implications of Whole Number Bias. *Educational Psychologist*, 40(1), 27–52. doi:10.1207/s15326985ep4001_3
- O'Donnell, A. M., & Dansereau, D. F. (1995). Scripted cooperation in student dyads: A method for analyzing and enhancing academic learning and performance. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 120-141). New-York: Cambridge Press.
- O'Donnell, A. M., & King, A. (Eds.). (1999). *Cognitive perspectives on peer learning*. Mahwah, NJ: Lawrence Erlbaum.
- OECD. (2009). *Overcoming Social Background: Equity in Learning Opportunities and outcomes*. Retrieved from <http://www.oecd.org/pisa/pisaproducts/48852584.pdf>
- Rabe-Hesketh, S., & Skrondal, A. (2012). *Multilevel and longitudinal modeling using Stata (3rd ed.)*. College station: StataCorp.
- Rittle-Johnson, B., & Alibali, M. W. (1999). Conceptual and procedural knowledge of mathematics: Does one lead to the other?. *Journal of educational psychology*, 91(1), 175. doi:10.1037/0022-0663.91.1.175
- Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents’ achievement and peer relationships: the effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin*, 134(2), 223–246. doi:10.1037/0033-2909.134.2.223
- Saleh, M., Lazonder, A. W., & De Jong, T. (2005). Effects of within-class ability grouping on social interaction, achievement, and motivation. *Instructional Science*, 33(2), 105-119.

- Saleh, M., Lazonder, A. W., & De Jong, T. (2007). Structuring collaboration in mixed-ability groups to promote verbal interaction, learning, and motivation of average-ability students. *Contemporary Educational Psychology*, 32, 314–331. doi:10.1016/j.cedpsych.2006.05.001
- Schwarz, B. (2009). Argumentation and learning. In N. Muller Mirza & A.-N. perret-Clermont (Eds.), *Argumentation and education. Theoretical foundations and practices* (pp. 91-126.). New York: Springer.
- Schellens, T., Van Keer, H., De Wever, B., & Valcke, M. (2007). Scripting by assigning roles: Does it improve knowledge construction in asynchronous discussion groups? *International Journal of Computer-Supported Collaborative Learning*, 2(2-3), 225-246.
- Sharan, S. (Ed.). (1999). *Handbook of cooperative learning methods*. Westport: Greenwood publishing group.
- Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., ... & Chen, M. (2012). Early predictors of high school mathematics achievement. *Psychological Science*, 23(7), 691-697. doi: 10.1177/0956797612440101
- Slavin, R. E. (2014). Cooperative learning and academic achievement: why does groupwork work? *Anales de Psicología*, 30(3), 785-791.
- Snijders, T., Berkhof, J. (2008). Diagnostic Checks for Multilevel Models. In J. De Leeuw & E. Meijer (Eds.), *Handbook of Multilevel Analysis*. New York, NY: Springer.
- Tarim, K., & Akdeniz, F. (2008). The effects of cooperative learning on Turkish elementary students' mathematics achievement and attitude towards mathematics using TAI and STAD methods. *Educational studies in Mathematics*, 67(1), 77-91. doi: 10.1007/s10649-007-9088-y
- Tolmie, A. K., Topping, K. J., Christie, D., Donaldson, C., Howe, C., Jessiman, E., . . . Thurston, A. (2010). Social effects of collaborative learning in primary schools. *Learning and Instruction*, 20(3), 177-191. doi: 10.1016/j.learninstruc.2009.01.005
- Walmsley, A. L., & Muniz, J. (2003). Cooperative Learning and Its Effects in a High School Geometry Classroom. *Mathematics Teacher*, 96(2), 112-116.
- Webb, N. M. (1991). Task related verbal interaction and mathematics learning in small groups. *Journal for Research in Mathematics Education*, 22(5), 366-389.
- Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology*, 79(1), 1-28. doi: 10.1348/000709908x380772
- Webb, N. M., Farivar, S. H., & Mastergeorge, A. M. (2002). Productive helping in cooperative groups. *Theory Into Practice*, 41(1), 13.
- Webb, N. M., Troper, J. D., & Fall, R. (1995). Constructive activity and learning in collaborative small groups. *Journal of Educational Psychology*, 87(3), 406. doi: 10.1037/0022-0663.87.3.406
- Yusof, J., & Malone, J. (2003). Mathematical Errors in Fractions : A Case of Bruneian Primary 5 Pupils. In 26th Annual Conference of the Mathematics Education Research Group of Australasia.
- Zakaria, E., Chin, L. C., & Daud, M. Y. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. *Journal of Social Sciences*, 6(2), 272-275. doi: 10.3844/jssp.2010.272.275

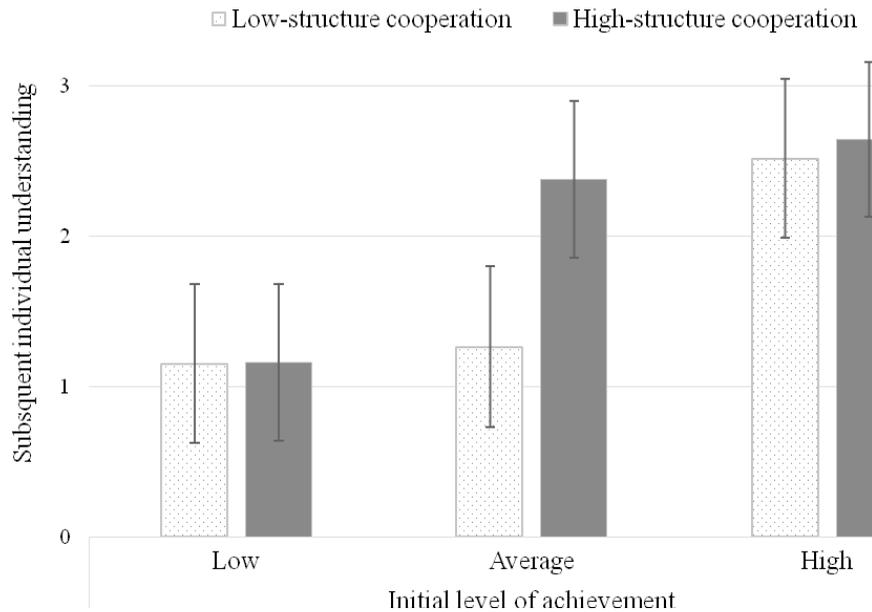


Figure 1. Individual level of understanding as a function of initial level of achievement and structure of cooperation. First set of analyses.

Notes: Error bars represent 95% confidence intervals of the estimated means.

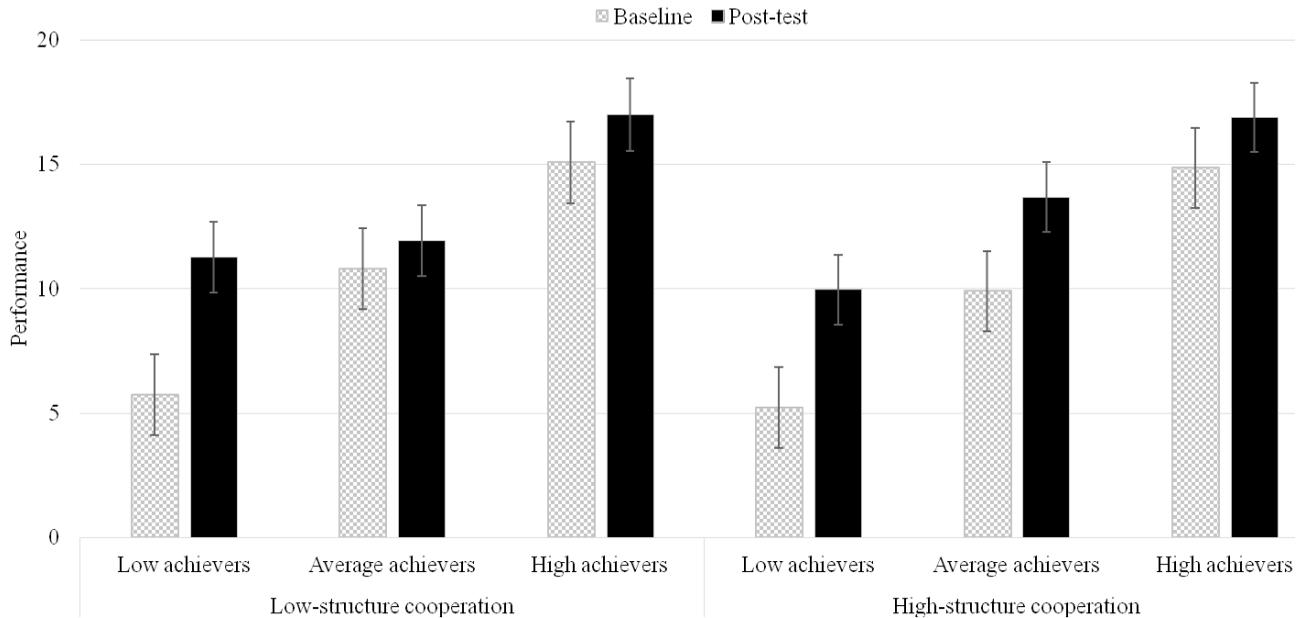


Figure 2. Baseline-to-post test progress as a function of initial level of achievement and structure of cooperation. First set of analyses.

Notes: Error bars represent 95% confidence intervals of the estimated means.

Appendix A. Card rule 1: “Responsible of reasoning”.

Responsible of reasoning

EXPLAINING THE THREE REASONING

“I want to share equitably 4 identical pizzas in 3 guests”

Reasoning 1	Reasoning 2	Reasoning 3
We can give everyone a pizza and then cut the last one and give a part to each of them.	We can cut each pizza into three parts and distribute a portion of each pizza to every guest.	We can cut all the pizza in three parts and give three parts, representing a whole pizza and a part of another pizza to each guest.
 $1 + \frac{1}{3}$	 $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$	 $\frac{4}{3}$
Addition of whole number and fractions	Addition of fractions	Fractional writing

- I explain my reasoning for writing.
- I make sure that everyone understands :
 - “Did you have some questions?”
 - “Is that is enough clear to you?”

Appendix B. Card Rule 2: “Communicate with appropriate vocabulary”.

Responsible of vocabulary

COMMUNICATE WITH APPROPRIATE VOCABULARY

$$\frac{1}{3}$$

One-on-three

⇒ A third



- I write the common response on the paper.
- I make sure that my friend uses the appropriate vocabulary.

Appendix C. Card rule 3: "Responsible of writing equivalence".

Responsible of writing equivalence

VERIFYING THE EQUIVALENCE OF WRITING

"Equivalent writing are writing which represent all the same number"

 $1 + \frac{1}{3}$	 $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$	 $\frac{4}{3}$
Addition of whole number and fractions	Addition of fractions	Fractional writing

- I make sure that writings are equivalents.
- I make sure that everyone is agree:
 - "Are you agreeing?"
 - "Can we write it on the paper?"

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Структурално кооперативно учење као средство унапређења просечних постигнућа ученика приликом учења разломака из математике

У основној школи учење разломака је најважнија област у настави математике. Усавршавање основних процедура које се тичу разломака представља тешкоћу за многе ученике. Циљ овог истраживања је да се представи структурално кооперативно учење као средство које може да унапреди учење ученика, а ово се посебно односи на просечне ђаке. У претходном истраживању утврђено је да хетерогене групе (у којима су ученици који постижу мали, просечан и велики успех) могу да буду штетне за ученике који имају просечна постигнућа, јер су они искључени из односа наставника и ученика који имају лоша или добра постигнућа. Ово истраживање предлаже да се структурише интеракција ради побољшања постигнућа просечних ученика у хетерогеним групама.

Приликом овог истраживања, сто осам ученика петог разреда радило је заједно у хетерогеним тријадама које су сачињене према резултатима на иницијалном тесту (један ученик са ниским нивоом постигнућа, један са средњим и један са високим). Тријаде су насумично биле изложене нискоструктурисаним и високоструктурисаним условима кооперативног учења. У свим тријадама ученицима је било наложено да раде заједно, водећи рачуна о свом учењу и учењу својих партнера.

Математички задатак је укључио три вештине: 1) разумевање разломачког резоновања (сабирање целог броја и разломка, сабирање разломака, писање разломака); 2) схватање еквиваленције писања разлике; и 3) способност коришћења адекватног вокабулара. Да би се радило на поимању разломака, предложили смо типичне вежбе које се користе у националном курикулуму. Тријаде су морале да изразе дужину једног сегмента, користећи три лењира са различитим подјединицама и поштујући три математичке вештине које се односе на разломке. Стандардно мерење је било загарантовано различитим подјединицама под именом „три лењира“. Ученици су морали да напишу дужину сегмента користећи што је могуће више израза, уз адекватан речник. Такође, морали су и да провере да ли су сви изрази били еквивалентни. Од њих се захтевало да користе лењире да би измерили сегмент. Три социјалне одговорности су такође обухваћене: проверавање да ли су сви разумели, потврђивање да се сви слажу око заједничког одговора и обавештавање о заједничком одговору. Ученици су извештавали о заједничком одговору на групном листу (позитиван циљ и независност). Били су замољени да

подстакну једни друге и да објасне резонување (конструктивна интеракција). Такође, било им је речено да ће радити индивидуални тест после рада у групи (индивидуална одговорност). Ова кооперативна упутства су дата у оба случаја.

У условима ниске структурисаности материјал је подељен свим ученицима (то јест сваки ученик је имао три различита лењира). Ученици су морали да примене три математичке вештине (објашњавање резонувања, проверавање еквивалентности израза и коришћење адекватног речника). Морали су да продискутују о одговорима у тријадама користећи све вештине и лењире; морали су да буду сигурни да су сви разумели и да онда саопште заједничке одговоре. Организовали су рад у групи како год су желели.

Полази се од премисе да ученици који имају просечна постигнућа могу да буду мање активни у хетерогеној групи и да преузимање активне улоге приликом објашњавања представља главни елемент у математици и веома велики структурално-кооперативни услов за учење који има за циљ да сви ученици у тиму буду укључени у математичке дискусије и групне одлуке. Уз то, увели смо дистрибуцију материјала, комплементарну експертизу и мењање одговорних ученика током вежбе. У условима високе структурисаности, материјали су били подељени међу ученицима у свакој тријади (то јест један лењир по особи) и свако би постао експерт за тај лењир пре него што објасни стечене вештине вршњацима у одређеним тријадама. Посебно смо направили листу одговорности које су се базирале на циљним математичким вештинама и циљним социјалним одговорностима и предложили им да ученици наизменично врше дужности током вежбе. Ова процедура је предложена да би се ојачала индивидуална одговорност и позитивна међузависност.

После вежбе у тријадама процењивано је индивидуално разумевање и онда су ученици расправљали о индивидуалним завршним задацима са разломцима. Опсервацијом суобухваћени ученици (то јест ниво 1) који су били у тријадама (то јест ниво 2) и они који су били у учионицама (то јест ниво 3). Резултати су показали да високо структурисано кооперативно учење даје примат разумевању задатог задатка, нарочито за ученике просечних способности. Штавише, ученици на свим нивоима су напредовали од иницијалног теста до завршног теста. Заправо, ученици са малим и великим постигнућима су подједнако напредовали код оба услова, док су просечни напредовали више код високо структурисаних услова.

Када се узму заједно, ови резултати потврђују да више структурисани (у односу на мање) бивају ефектнији за просечне ученике него за оне који постижу горе или боље резултате од просечних, и који могу да имају користи од сарадње без обзира на структурни ниво. Још једна важна чињеница добијена овом студијом је да ниво структуре нема ефекта на разумевање или на напредовање ученика са малим и великим постигнућима. Ови налази говоре да структура која подразумева да сви ученици буду социјално и когнитивно укључени током групног рада представља круцијалну компоненту која омогућава ученицима просечних постигнућа да имају користи од сарадње. Наша студија предлаже педагошки кооперативни метод учења који може да се користи у учионици да би се побољшала организација социјалне интеракције у хетерогеним групама и да би се подржало разумевање и учење свих ученика који учествују у групама.

Кључне речи: кооперативно учење, структура, учење разломака, ученици просечног постигнућа, математика.

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How we can support success in solving mathematical problems?

Abstract: *The basic research question dealt with in this study is how to identify the main obstacles that students encounter in solving tasks in mathematics in order to define typical steps in mastering the mathematical skills needed for solving the applied tasks.*

In conceptual terms, this study is situated into the contemporary definition of mathematical literacy as a competence that allows the individual to understand the world in which he/she lives, and makes him/her qualified to make informed decisions (e.g. OECD / PISA). This research had two phases. Study was divided into two phases, both of them included sample of first-grade high school students, which is consistent with the PISA criteria for determining sample. During students' individual or interactive work on tasks, their comments were collected as qualitative data in order to determine the ways in which students make mistakes, what are the difficulties encountered if the tasks are placed in a realistic context, and to determine which of these errors and problems are typical. Content analysis of students' verbal communication during task solving served to extract the problems that make solving strategies ineffective. In the second (quantitative) phase of our research, we tested if they could be used as a clear diagnosis that indicates a systemic deficiency in the teaching of mathematics and instruments for assessing student achievement. The sample consisted of 379 first grade students of Belgrade high schools. The results show that the concept of probability is intuitively close to the students' experience. Narrative rather than a graphical display of data is more efficient support in problem solving. Suggesting step-by-step-approach to problem solving significantly increases performance. Recommendation for teaching practice is to introduce the concept of probability at earlier school ages and to integrate it with other themes in mathematics. Problem-solving strategies should be developed through active teaching of mathematics, in particular the skills of subdivision of a problem into stages.

Key words: *mathematical literacy, problem solving, probability, strategies for solving tasks, OECD/ PISA).*

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Education in Serbia still lacks the established quality assurance system, whose function is, above all, to formulate further directions of development of education on the basis of evidences on quality, equity, and efficiency of the current educational practices. During the past decade this gap in the national evidences is to some extent compensated with the results of international assessment studies of student achievements in which Serbia was involved, such as programs of OECD/PISA and TIMSS. The findings of these research programs consistently show that the educational achievements of students from Serbia in terms of mathematical competence are below the international average. The gap in achievements compared to the international average is especially prominent when it comes to mathematical tasks that have the elements of the problem-situation that request application of mathematical knowledge in realistic situations (Baucal, Pavlovic Babic, 2011; Baucal, Pavlovic Babic, 2009; Baucal, 2006; OECD, 2004; OECD, 2007; OECD, 2010).

Conceptual framework: the PISA study

The research is based on materials and information on the achievements of students from Serbia within the framework of the International Programme for Student Assessment (PISA).

The PISA study systematically monitors the level of functional literacy in the field of mathematical, scientific and reading literacy the fifteen-year-old have attained in a given country. These three domains have been selected as the most general and the most relevant indicators of quality and equity of education (OECD, 2009a), as well as predictors of economic and social growth of society (OECD, 2009b). The specificity of the PISA study is that it does not examine the extent to which students can reproduce knowledge they have learned in school, but rather to what extent are they competent to understand and use available information and knowledge in solving relevant real-life problems. In ad-

dition, the goal of the PISA study is to determine the extent to which different contextual factors (the characteristics of the education system, school characteristics, the characteristics of the family environment, and the characteristics of students) are related to the educational achievements of students (Rychen & Salganik, 2003; OECD, 20054; Baucal & Pavlovic Babic, 2009). OECD/PISA is arguably the most frequently referred international program in the field of education and one of the most important landmarks for educational policy. For example, literacy estimated according to the PISA test is one of the instruments that, at the EU level, is used for monitoring progression toward objectives of the EU Strategy 2020 (Earl, 2006; European Commission, 2010).

The concept of mathematical literacy

Understanding the concept of mathematical literacy derived from the PISA study resulted with the following definition: Mathematical literacy assumes the individual's ability to recognize and understand the role that mathematics plays in the modern world, to make decisions based on facts and to use mathematics in order to conduct as constructive and research-oriented person able to assess himself/herself and the environment- (OECD, 1999). In short, the focus of such definition of mathematics, and therefore the role of the education system in the development of mathematical knowledge, is on the functional aspect of knowledge, that is on the use of knowledge.

Undoubtedly, in recent years a large number of countries (educational systems) have been devoted to examination and reorganization of their own curricula in mathematics, trying to solve the problem of "overemphasis on procedure and neglect of understanding" (de Lange, 2003), with clear orientations towards the integration of content. For example, in the mathematics curricula adopted in Poland, the program contents are organized by subjects, and at each level of education there is a list of compul-

sory cross-curricular topics whose inclusion in the school curriculum is the responsibility of the school management/director (Polish Eurydice Unit, 2005). A similar solution was applied recently in Serbia by defining general and cross-curricular competencies for primary and secondary education. For Poland, we already know that applied reform measures positively affected the quality of education, which is visible, among other things, by the increase of the average achievement on the PISA tests. When it comes to Serbia, the question whether will introduced new competencies will find a way to become part of the everyday teaching practice still remains open.

Another high-achieving country in mathematics at the international testing is Singapore. Unlike academic approach to teaching mathematics which is typical in Serbia, curriculum in Singapore is problem-solving based. In Singapore, the central place of learning mathematics is the cooperative work on problem solving with a strong emphasis of metacognitive strategies (Ministry of Education, Singapore, 2013). In the textbooks, as well as in teaching, a large number of heuristics is in use (Fan & Zhu, 2007).

In short, based on comparative analysis of legal and teaching program documents, we can estimate that the curricula of education systems which produce high mathematical achievement contain the explicit strategies for the support and development of higher order thinking (problem-solving, critical thinking), while in Serbia higher order thinking is not connected with specific content, but is only given as a general educational goal, with weak (if any) instructional power.

The PISA achievements of students from Serbia

During the four research cycles in which Serbia participated the average scores of Serbian students in 2003 were 437 points (on the scale with the arithmetic mean of 500, and standard deviation of 100), in 2006 it was the same one, in 2009 it was

raised to 442 points, while in 2012 it was 445 (Pavlovic Babic, 2007; OECD, 2007; Baucal & Pavlovic Babic, 2011; Pavlovic Babic, & Baucal, 2013). Taking into consideration that one year of schooling has an average impact of 40 points on the PISA scale, it means that Serbian students are lagging behind for more than one school year compared to the international average.

Further analysis shows that the mathematics achievement of students from Serbia gradually increases in average 2 points per year. Although this is statistically significant, the advance rate is very small. With the trend of 2 points per year, Serbia should be about 25 years to reach the average achievement realized by students from OECD countries in 2012 (Pavlovic Babic, & Baucal, 2013).

The average achievement has placed our students at the second level of the PISA achievement scale, which means that during the nine years of schooling, on average, students are trained to apply simple procedures, to find specific information using a single source for finding solutions in a simple situation in which all relevant information was provided. Requirements for that level require of students cognitive activity at the level of reproduction.

Findings from PISA 2012 cycle also show that the achievements of 38.9% of students from Serbia are below the level of functional literacy (OECD, 2013). At the same time, the achievements of just a small number of students (4.6%) are at the two highest PISA math levels. This does not give an optimistic picture of the education system. Contrary, findings showed that the education is not oriented to compensate low achievement nor to encourage high ones.

All these findings suggest persuasively the need to improve the teaching of mathematics, particularly with regard to implementation of the acquired knowledge to problem situations in real life.

The main objective of the research study, similarly to our previous study (Anić & Pavlović Babić, 2011), was to test the effectiveness of various ways of supporting students to solve complex mathemati-

cal problems. Previous research studies conducted in Serbia show that the attention of researchers was much more focused on the factors that contribute to the achievement, such as motivation or school anxiety (Kovač Cerović i Radišić, 2015; Videnović i Radišić, 2011) or spontaneous strategies of students in problem solving (see, eg. Pavlović Babić, 2015). But, the researches dealing with the explicit strategies of problem solving are rare, at least when it comes to Serbia.

More specifically, the main aim was to identify the main obstacles encountered by students in solving these tasks, in order to, on this basis, formulate the typical steps in mastering the mathematical skills needed to solve the tasks situated in real context. Findings of this study can be useful from the perspective of improvement of teaching approaches.

QUALITATIVE STUDY

The aim. The aim of the qualitative part of the research is to identify different ways in which stu-

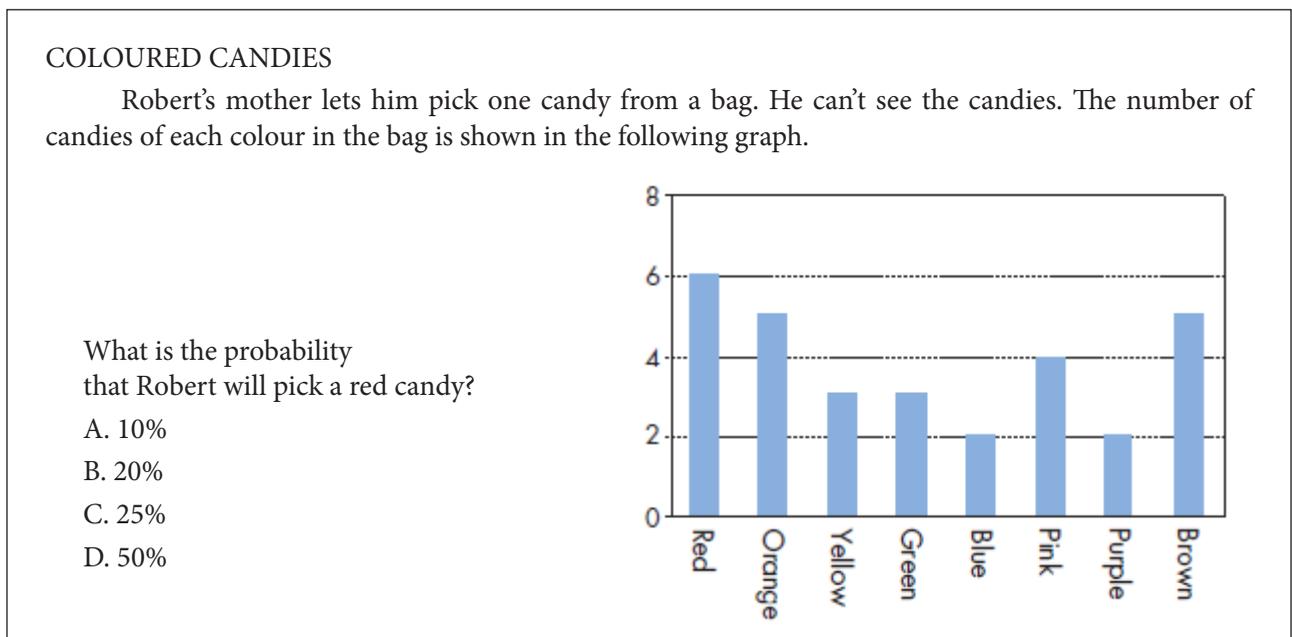
dents make errors and to explore the difficulties they encounter in solving PISA tasks placed in a realistic context; finally, to identify which of these errors and difficulties are typical for Serbian students. The findings of this part of the study were used to construct new variants of the same PISA tasks where such difficulties are escaped.

Method

Description of the instrument and the research process. Students had to solve 6 tasks (4 taken from PISA, and 2 developed by the authors of the paper). The tasks were situated in a realistic life context and suited to the school age and experience of the respondents. Tasks tested different mathematical competences with graduated complexity. Due to limitations in the scope of this paper, we present only one of the tasks (Figure 1).

This is the original PISA task (Pavlovic Babić & Baucal, 2009). It is a multiple choice question tied to everyday experience. All relevant informa-

Figure 1: The original version of the task 3



tion is given. The graph is simple and it is not essential for solving the task.

Students were expected to understand that the probability of drawing a red candy is equal to the percentage of red candies in the total number of candies in the bag.

In the curriculum for primary school, graphic data were not present until the school year 2009/10, so that students tested here were not used to this way of presentation of information in mathematics.

In Serbia, the concept of probability is not mastered before this level of education, so that students rely on implicit lay knowledge and analogies in solving these problems. The task is solved in several steps. Conceptual knowledge required for problem-solving and knowledge of procedures qualifies this task for the fourth achievement level (549 points on a scale of achievement). At the level of OECD countries 50% of students solve this task (OECD, 2009c).

The sample. The sample includes 15 fifteen years olds students from upper secondary education, i.e. students attending the first grade of the upper secondary schools (this educational ages being tested in PISA).

In this part of the study 6 students from a Belgrade Gymnasium (2 working individually and 4 in pairs) and 9 students of a School of Economics in Belgrade (3 individuals and 6 working in pairs). Students were selected based on two criteria in consultation with the math teacher: (a) ability to reflect and express their thinking aloud, and (b) school marks in mathematics. Considering that the aim of this phase was the determination of different problem-solving strategy, the highly expressive students with high achievement in mathematics were chosen.

Results

The content analysis was applied on data collected during the qualitative part of the study. Unlike other qualitative techniques, dialogic problem solving proved to be particularly suitable for the

purposes of this study (Snape & Spencer, 2003), because it is made possible insight into the strategies that students apply. The analysis can take only those parts of dialogues. The analysis can take only those parts of the dialogue which were explicitly referred to the way of solving problems. Other parts of the dialogue, including non-verbal communication, are ignored.

Content analysis of verbal communication during solving all included PISA tasks revealed the following problems, which make the solving strategies ineffective:

1. Choice of the relevant data. It turned out that the students had false expectations that all information given must be used in order to come up with a solution. This false belief leads to erroneous attempts to solve, and illogical results lead them back to the beginning. All students were able to overcome the difficulties, and the process lasted from 30 seconds to 3 minutes.
2. Reading the information presented in the picture. The picture obstructs the process of solving the tasks in the following ways:
 - Wrong interpretation of the picture - for instance, a schematic representation of the staircase (the first task) misled students to apply the Pythagorean Theorem.
 - Visually striking difference in the height of columns on the chart led to a quick, laconic answer that difference is great because it is clearly so in the picture.
 - Checking and comparing the information given in the picture and in the text. This strategy is not wrong, but it is redundant and slows down the solving process.
3. Relating the different phases during the problem solving. All students who participated in this part of the research, except one pair, tried to respond directly to the

assignment, on the basis of the given information, without any attempt to analyze and reflect.

4. Presentation of information by spatial distribution of objects, or a scheme or on the mental plane.

Based on the identified problems, we have intervened in tasks (re-designed them) so to avoid typical mistakes, or to help students move on to the next phase of problem solving. For each math problem, two additional variants were defined: Variant B, in which the task is made easier removing barriers in solving, and variant C, which is further facilitated by being made the first step that leads to a solution.

QUANTITATIVE STUDY

The specific objective of the quantitative phase of the research presented in this paper was to whether errors and difficulties registered in the previous phase are typical for Serbian students. Being typical, they clearly identify and indicate a systemic issues in the teaching of mathematics as well as potential validity issues related to the PISA math tasks using for assessing math achievement of Serbian students.

Method

Instruments

The research was designed so that, by intervening in the nature of the tasks, we eliminate or reduce the possibility of error and thereby increase efficiency in solving problems. On the basis of errors in problem solving, noted during the qualitative study, tasks are modified in one of the following ways: remove redundant information, remove the image when the information are given in narrative, divide the instruction into clearly defined steps of solving process, and explicitly pointed out the nature of the data.

Prior, explicit division of instruction in stages (steps) results in increased success in solving the tasks. Statistically, we expect students to be more successful in solving B and C variants of the original tasks.

Variables

Dependent variable:

- Mathematical achievement in solving of problems expressed by the accuracy of solving particular tasks in the test.

Independent variables:

- Assessment of mathematics, as a measure of student's school achievement;
- • The number of points in the admission exam at the end of the eighth grade.

Control variable:

- Age of respondents. All the participants in this study were of the same age of the formal education (the first year of secondary school).

Hypotheses

Here is the list of all hypotheses tested in the research. In discussion, we focus on hypotheses 3, 4 and 7, which are related to the presented task 3.

1. Elimination of redundant data in the first task increases the effectiveness in solving problems. Removing the image in the same task, as redundant, increases success in solving tasks.
2. Pointing to the nature of the data in the second task increases the effectiveness in solving tasks. Direct instruction to use of the same data additionally increases performance.
3. Definition of phases of the problem solving increases effectiveness in solving tasks.
4. Removing image, when the data are already contained in narrative, increases effectiveness in solving problems.

5. Referring to the position of the objects on the plane increases the success.
6. The first graders (high school) do not have competence to apply the reverse Pythagorean Theorem in a real context. We expect that, regardless of the fact that students meet with numerous tasks using the Pythagorean Theorem, the number of students who are able to exactly solve the task is very small.
7. School success, presented as scores in mathematics at the end of eighth grade and the results of the qualifying exam in mathematics, is a predictor of the achievement on the math test. We expect that students who are successful in solving math problems within a real life context will have significantly better scores of school success (scores in mathematics achievement in the

admission exam) than the students who fail to solve these tasks.

Instrument

Based on the findings from the qualitative part of the study we conceived for each task two variants - variant B and variant C in which the identified difficulties and errors were escaped. For example, variant B of the task 3 is worded so that suggests the division of tasks in phases. In this variant, the assistance was not given either as explanation of the concept of probability or as a suggested procedure for solving a task.

In version C of the third task (Figure 3) the data are supplied narratively rather than as a graph. In addition, the word *probability* is replaced with the word *chance* that, in our view, is closer to the students' experience.

Figure 2 and 3 shows a modified variant of the task 3rd.

Figure 2: Variant B of the third task

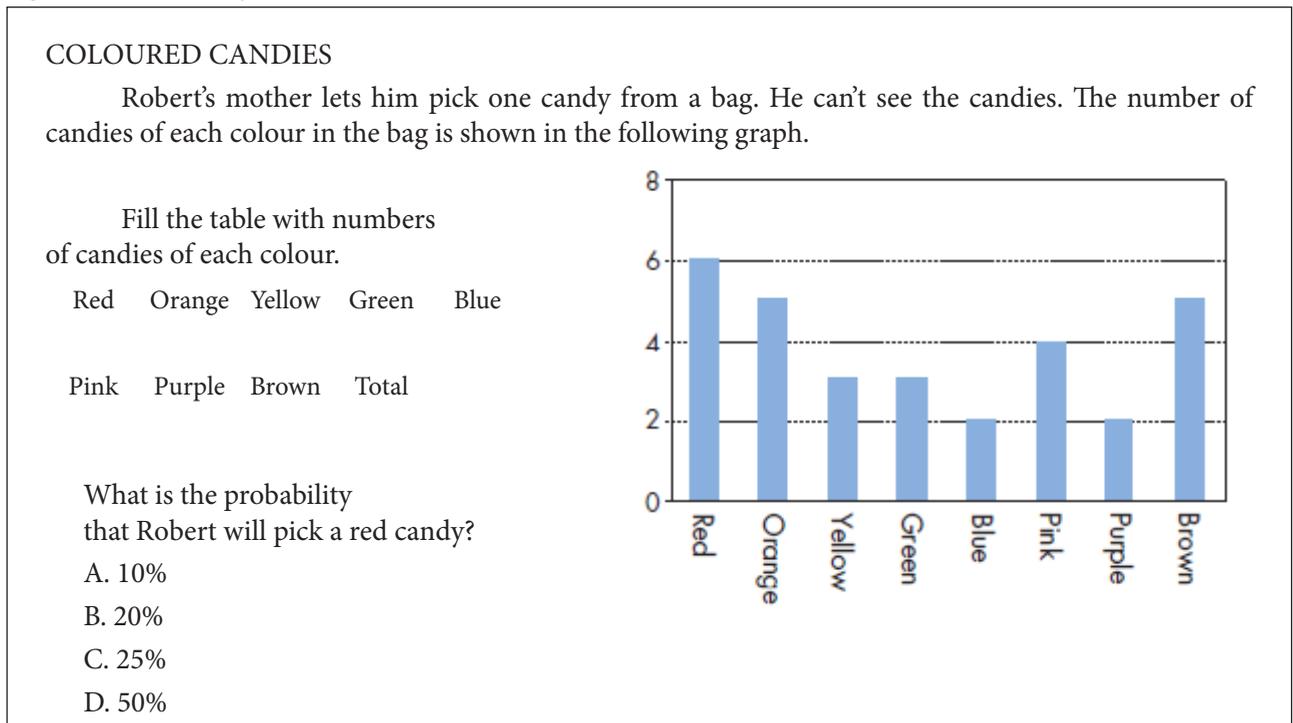


Figure 3: Variant C of the third task

COLOURED CANDIES

Robert's mother lets him pick one candy from a bag. He can't see the candies. The bag contains 6 red, 5 orange, 3 yellow, 3 green, 2 blue, 4 pink, 2 purple, and 5 brown candies.

What is the chance that Robert will pick a red candy?

A. 10%

B. 20%

C. 25%

D. 50%

There were three versions of the test, each comprising the 6 tasks: two tasks of variant A, two tasks of variant B, and two tasks of variant C, so that each of the tested students took two tasks of each variant. In this way the load was spread evenly and the decrease of motivation for difficult tasks was avoided. Table 1 presents the structure of all versions of the test.

Table 1. Test structure

	First task	Second task	Third task	Fourth task	Fifth task	Sixth task
First version	A	B	C	C	B	A
Second version	C	A	B	B	A	C
Third version	B	C	A	A	C	B

Sample

A total of 379 students from four high schools took part in solving the tasks. The sample of schools was expedient, and within each school the classes have been selected randomly. In each class students were randomly divided into three groups. Each group worked with one version of the test.

Subsequent analysis of school success (average scores in mathematics at the end of the eighth grade and result in the admission exam) shows that the groups of students who worked with three versions of the test were equal in these variables. Table 2 shows data on the number of students according to schools and the test versions, with data on school performance.

Table 2. Sample structure and data on school performance

	School 1	School 2	School 3	School 4	Total	Entrance Exam Score	Average School Mark
Version A	30	30	42	22	124	15.51	4.11
Version B	27	29	40	33	129	15.50	4.24
Version C	29	26	41	30	126	15.66	4.15
Total	86	85	123	85	379		

Data processing plan

The data were processed in the SPSS statistical package. We applied the descriptive statistical analysis (significance of differences of arithmetic means).

Findings

Table 3 shows the frequency response of students.

Table 3. *Response distribution according various variants of the third task*

	Correct Answer	Correctly Filled Table (B)	Wrong Answer	Did not work
Variant A	36.51%		61.90%	1.59%
Variant B	46.51%	96.90%	53.49%	0.00%
Variant C	54.03%		44.35%	1.61%

The data show that between the students who solved modified variants of the task and the students who have worked with the original version, there are significant differences in achievements. We used the t-test for equality of proportions in the three variants of the task (every two variants were compared); these findings are presented in Table 4.

Table 4. *Testing equality of proportions with various variants of the third task*

	A-B	A-C	B-C
Expected difference	-10.00%	-17.52%	-7.52%
p-value	0.053*	0.003**	0.117

Analysis of the data indicates the following:

1. Practically, all students know to read data from the chart. Although in school prac-

tice such representation of data is not used, graphic representation of the data is understandable to students, probably as part of their everyday experience (this kind of presentation is often used by electronic and printed media).

2. Pointing to the first step significantly helps in solving the task (the difference between variants A and B). It was enough just to point to the division of the solving process into stages, and students would significantly better do the job. This confirms the third hypothesis of this study.
3. Statistical analysis showed that between students who worked on variant B and those who worked on variant C there is no significant difference in achievement. Therefore, the analysis of the data does not support the fourth hypothesis.
4. We have analysed the extent to which school achievement in mathematics predicts the performance on a task 3. The results are shown in Table 5. They indicate that the seventh hypothesis is confirmed only for the modified variants of task, and only in the case of school success as measured by scores in mathematics in the 8th grade. In task variant A data do not indicate the existence of any positive correlation between success on the tasks and school success, i.e. better academic achievement in no way guarantees better achievements in the test.

Table 5. Testing difference averages in school success and wrong solution of the third task

		Variant A		Variant B		Variant C	
		Correct	Wrong	Correct	Wrong	Correct	Wrong
Math. scores in VIII grade	Average	4.174	4.137	4.383	4.120	4.284	3.912
	Expected difference	0.036		0.267		0.371	
	p-value	0.420		0.041*		0.014**	

5. There is a big difference in achievements between variants A and C. In variant C, the task was fully translated into narrative and the word “probability” was replaced by the term “chance”, which is used in everyday communication. Obviously, there were two interventions in this task, but both in the same spirit. Since the result for variant B shows that the students were able in almost hundred per cent to read the chart, we can assume that the replacement of terms (*chance* instead of *probability*) had greater influence on the difference in achievements. The overall conclusion would be that closer the task is to everyday language and experience of students (e.g. lower level of abstraction, less symbolic representation, informal language...), better gets the students’ involvement in problem solving. This leads us to the conclusion that the difference in achievement does not depend on mathematical knowledge, but on the ability to translate the real situation into the language of mathematics; very likely, the same effect happens with the direct motivation for solving the task, which was increased by placing the task in the known context.

Discussion and Conclusion

The qualitative part of the research shows that most students understand the concept of probability, although they did not encounter with this notion at school; they translate it as “chance” or “likelihood”. This notion is so natural that some students were not even aware of the fact that it was not a part of the school teaching.

The results of the quantitative part of the study show that students have more difficulties with segmentation of the solution process into the stages than with the concept of probability. It is clear that in a naive form this concept should be introduced much earlier in school curriculum, mostly due to the great importance that the probability and statistics play in contemporary society. Today, the concepts of statistical probability are a part of general education; it goes without saying that the admission tests for almost all jobs contain problems of that kind. The absence of probability and statistics from teaching mathematics in Serbia is systemic; it would be much better if teaching mathematics incorporates these concepts soon and in the early grades of elementary school. Problems of probability and statistics are by their nature realistic and can greatly inspire students. In addition, knowledge of basic statistical concepts expands students’ opportunities for research, not only in mathematics, but also in other areas.

In accordance with the best educational practices in the world, teaching of mathematics in Serbia should be a problem and project oriented. In this way, we could achieve greater involvement of students in teaching/learning process and develop problem-solving strategies needed for the further education, as well as for functioning in daily life. It is also the basis for developing higher order thinking including critical thinking.

Initial teacher education in Serbia, as it is today, is more focused on building mathematical knowledge and less on the development of teacher competencies. This is why we recommend that the

initial education and professional training of teachers include, in greater extent, the development of teaching skills, aimed at organizing problem solving and project-oriented teaching.

Even with unchanged initial teacher education and unchanged mathematics curricula in schools in Serbia, we believe that it is possible to make changes at the classroom level. Even very strict curricula still leave the place for teachers to bring a problem-solving and project component in the teaching of mathematics. In that way, students would be more engaged during the class, teaching would be more interesting, and achievements would increase.

References

- Anić, I. & Pavlović Babić, D. (2011). Rešavanje matematičkih problema u realnom kontekstu: kvalitativna i kvantitativna analiza postignuća. *Nastava i vaspitanje*, 2, 193-205.
- Baucal, A. & Pavlović Babić, D. (2009). *Kvalitet i pravednost obrazovanja u Srbiji: Obrazovne šanse siromašnih*. Belgrade: Ministarstvo prosvete Republike Srbije, Vlada Republike Srbije, Institut za psihologiju.
- Baucal, A. & Pavlović Babić, D. (2011). *Nauči me da učim, nauči me da mislim, PISA 2009 u Srbiji: prvi rezultati*, Belgrade: Institut za psihologiju i Centar za primenjenu psihologiju.
- Baucal, A. i sar. (2006). *Obrazovna postignuća učenika III razreda – nacionalno testiranje 2004*, Beograd: Zavod za vrednovanje kvaliteta obrazovanja i vaspitanja. <http://www.ceo.edu.rs/images/stories/publikacije/ObrazovnaPostignucaUcenika.pdf>
- Earlt, H. (2006):. European Union policies in education and training: the Lisbon agenda as a turning point? *Comparative Education*, 42 (1,) 5-27.
- European Commission (2010): *Europe 2020: A European strategy for smart, sustainable and inclusive growth*., Brussels: European Commission.
- Fan, L., & Zhu, Y. (2007). Representation of problem-solving procedures: A comparative look at China, Singapore, and US mathematics textbooks. *Educational Studies in Mathematics*, 66(1), 61-75.
- de Lange, J. (2003). Mathematics for Literacy. In B. L. Madison, & L. A. Steen (Eds). *Quantitative Literacy: Why Literacy Matters for Schools and Colleges*, Princeton, New Jersey: National Council on Education and the Disciplines. 75-89.
- Kovač Cerović, T. & Radišić, J. (2015):. Sprega motivacije i postignuća učenika: doprinos PISA 2009. In J. Radišić, & N. Buđevac, (Eds.), *Sekundarne analize istraživačkih nalaza u svetlu novih politika u obrazovanju* Belgrade: Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije i Društvo istraživača u obrazovanju. 144-158
- Ministry of Education, Singapore (2013). *Primary Mathematics Teaching and Learning Syllabus*, <http://www.moe.gov.sg/education/syllabuses/sciences/files/math-primary-2013.pdf>

- OECD (1999). *Measuring Student Knowledge and Skills: A New Framework for Assessment*. Paris: OECD Publications.
- OECD (2004). *Learning for Tomorrow's World: First Results from PISA 2003*. Paris: OECD Publications.
- OECD (2007). *PISA 2006: Science competencies for tomorrow's world*. Paris: OECD Publications.
- OECD (2009a). *Education at a Glance*. Paris: OECD Publications.
- OECD (2009b). *Education Today: The OECD Perspective*. Paris: OECD Publications.
- OECD (2009c). *PISA 2009 Results: What Students Know and Can Do*. Volume I, Paris: OECD Publications.
- OECD (2013). *PISA 2012 Results: What Students Know and Can Do – Student Performance in Mathematics, Reading and Science (Vol. 1)*, Paris: OECD Publications.
- Pavlović Babić, D. (2015). Faktori koji doprinose postignućima na PISA zadacima čitalačke pismenosti. In J. Radišić & N. Budjevac (Eds.), *Sekundarne analize istraživačkih nalaza u svetlu novih politika u obrazovanju*. Belgrade: Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije i Društvo istraživača u obrazovanju. str. 118-121.
- Pavlović Babić, D. & Baucal, A. (2009). *Matematička pismenost*. Belgrade: Ministarstvo prosvete Republike Srbije, Zavod za vrednovanje kvaliteta obrazovanja i vaspitanja, Institut za psihologiju Filozofskog fakulteta Univerziteta u Beogradu.
- Pavlović Babić, D., & Baucal, A. (2013). *Podrži me, inspiriši me: Prvi rezultati PISA 2012 u Srbiji*, Beograd: institut.lel za psihologiju i Centar za primenjenu psihologiju.
- Polish Eurydice Unit (2005). *The System of Education in Poland*. Warsaw: Foundation for Development of the Education System.
- Rychen, D. S. & Salganik, L. H. (Eds.) (2003). *Key Competencies for A Successful Life and a Well-Functioning Society*. Cambridge: Hogrefe & Huber Publishers.
- Snape, D. & Spencer, L. (2003). The foundations of qualitative research. In: Richie, J. & Lewis, J. (Eds.). *Qualitative research practice. A guide for social science students and researchers*, London: SAGE Publications. 2-23.
- Videnović, M. & Radišić, J. (2011). Anksioznost u vezi sa učenjem matematike: Matematika - bauk ili ne? *Psihološka istraživanja*, 14, 157-177.

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Како се може поспешити успешност ученика у решавању математичких проблема?

Основно истраживачко питање којим се бавимо у овом раду је питање идентификовања погрешних стратегија и основних препрека у решавању проблемских задатака из математике, како би се дефинисале успешне подршке у процесу решавања, а које доводе до успеха.

Истраживање је реализовано у две фазе. Квалитативним истраживањем, у условима индивидуалног рада или рада у пару на задатку, настојали смо да утврдимо на које начине ученици греше и на које потешкоће наилазе при решавању задатака смештених у реалан контекст, као и да се утврди које од тих грешака и потешкоћа су типичне. Анализом садржаја вербалних исказа ученика током решавања задатака издвојени су проблеми који чине стратегије решавања неефикасним.

Квантитативним истраживањем проверавали смо у којој мери су грешке и потешкоће установљене у претходној фази типичне, што може бити јасан дијагностички знак који указује на системски недостатак у настави математике и инструментима за процену постигнућа ученика.

Узорак ученика обухвата петнаестогодишњаке, односно ученике првог разреда из четири средње школе у Београду. У квалитативном делу истраживања учествовало је петнаест ученика, а у квантитативном триста седамдесет и девет ученика. Узорак школа је пригодан, а у свакој школи су тестирана цела одељења која су насумично изабрана.

Узорак задатака чини шест проблемских математичких задатака, од којих су четири преузета из међународног програма провере ученичких постигнућа (ОЕЦД/ПИСА), а два су саставили аутори овог рада. Задаци су смештени у реалан контекст и у складу су са узрастом и искуствима испитаника. Задаци тестирају различите математичке компетенције и градуирани су по комплексности.

Анализом садржаја вербалних исказа ученика током решавања задатака издвојили су се следећи проблеми који чине стратегије решавања неефикасним: (1) Избор релевантних података – показало се да су ученици имали погрешна очекивања да сви дати подаци морају да се употребе да би се дошло до решења; (2) Читање сликом датих података – слика је ометала процес решавања задатака на следеће начине: погрешно интерпретирање слике, погрешно интерпретирање због нејасноће у графичком приказу података, проверавање и упоређивање података који су дати сликом и текстом, што доводи до успоравања процеса решавања задатка; (3) Повезивање различитих фаза у решавању задатка – показало се да ученици покушавају да директно дођу до решења без претходне анализе расположивих података; (4) Представљање, схемом или на менталном плану, података о просторном распореду објеката.

На основу уочених проблема, интервенисали смо у задацима тако да се избегну типичне грешке или помогне ученицима у преласку на наредне фазе решавања проблема. За сваки задатак формулисане су две олакшане верзије: Б верзија, у којој је дат директнији приказ података, и Ц верзија, у којој се ученици наводе на први корак у решавању задатка.

За потребе овог рада приказане су анализе које се односе на проблемски задатак из области вероватноће у којем су подаци дати графиком.

У квалитативном делу истраживања се показало да већина ученика зна за појам вероватноће, иако се са тим појмом нису сусрели у школи, и преводе га појмовима „шанса“ или „могућност“. Тај појам је толико природан ученицима да неки нису ни знали да у школи нису учили ништа о вероватноћи.

Резултати квантитативног дела истраживања показују да је већи проблем ученицима да поделе проблем у фазе него сам концепт вероватноће. Јасно је да овај концепт треба на један наиван начин много раније изучавати у школи, а највише због великог значаја који вероватноћа и статистика играју у савременом друштву. Статистичко-вероватносни концепти се данас убрајају у општеобразовне, и скоро да нема послова где се за пријем не раде тестови који садрже проблеме из ове области. Проблем мањка вероватноће и статистике у настави математике у Србији је системски и биће боље за наставу математике ако се ови концепти ускоро нађу у нижим разредима основне школе. Проблеми из вероватноће и статистике су по својој природи реалистични и могу у великој мери инспирисати ученике. Осим тога, познавање основних статистичких концепата проширује ученицима могућности за истраживачки рад, не само из предмета математика већ и у другим областима.

Налази истраживања могли би да имају импликације и на системска решења која се примењују у образовању, али и на свакодневну наставну праксу. Иновирање програма иницијалног образовања наставника математике, као и програма курикулума за основне и средње школе, требало би да иде у правцу подржавања наставничких компетенција за проблемску и пројектно организовану наставу којом би се подржали виши облици мишљења код ученика. У очекивању промена на системском нивоу могуће је унапредити и свакодневни рад у учионици тако што би се кроз проблемске задатке и кооперативни рад ученика на њима постигао виши степен ангажовања ученика у настави, подигао квалитет наставе и унапредила образовна постигнућа ученика у области математике.

Кључне речи: математичка писменост, решавање проблема, вероватноћа, стратегије решавања задатака, програм ПИСА.

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Learning science with dialogical maps

Abstract: The development of children's concepts is often still studied without taking into account school practices, namely, the verbal and instrumental activities in which these concepts develop. The present research is rooted in a Vygotskian perspective that defines thinking and its dynamics within the semiotic contexts where they take place. The article aims at showing how pupils were guided by their teacher to adopt an inquiry- and argumentative-based approach to learning science. Software developed to support argumentation and learning – an argumentative map called Digalo that provides a visual representation of the discussion – was used in the classroom by teachers and students to learn about astronomy. The data presented here were extracted from a European project (Escalate) which aimed to enhance science learning through argumentation and inquiry activities (Andriessen, Baker & Suthers, 2003; Muller Mirza & Perret-Clermont, 2008; Muller Mirza, Tartas, Perret-Clermont & De Pietro, 2007). Three elementary classes (grades 3, 4 and 5) participated in the study and were led to explain “why are there seasons?” in the course of different phases of debates guided by the teacher and mediated by argumentative maps. General quantitative results based on the comparison of pre-test and post-test scores showed that the students in grades 4 and 5 improved their knowledge whereas the 3rd grade students did not progress. A more detailed analysis of the different phases of the study was then carried out, focusing on the evolution of children's understanding of the seasons through the analysis of their productions (the structure and argumentative contents of their argumentative maps) and on how the 5th grade teacher scaffolded his students' sessions. The results showed that elementary school students can learn from debate oriented by argumentative maps and guided by the teacher. The roles of argumentative maps and teacher's scaffolding in learning and thinking processes are discussed from a sociocultural perspective.

Key words: learning in science, argumentation, semiotic tools and mediations, argumentative map.

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Introduction

The research presented here aims to show that even in elementary school where children have not yet developed scientific concepts², they can engage in a participatory way of doing science and can develop discursive practices as scientists (namely negotiating the meaning of a phenomenon through debate and dialogues mediated by cultural tools such as scientific data or schemas, drafts, etc.). “Learning and thinking are always *situated* in a cultural setting and always dependent upon the utilization of cultural resources” (Bruner, 1996, p. 4). This proposition was illustrated by studying some intermediate *œuvres* (Meyerson) by elementary school children in the course of a scientific activity that consisted in understanding the seasons. Three classes of 3rd, 4th and 5th grade students participated in constructing an argumentative map and then re-using it in a subsequent session guided by their teacher. Our research questions are: what practices take place when a particular tool is used in class to learn astronomy? And how are durable traces of scientific activity and thinking processes materialized in argumentative maps used by the teacher to develop the children’s understanding of a specific phenomenon, i.e., the seasons?

In psychology, the role of materiality or objects in shedding light on the development of knowledge is generally considered subsidiary. In Piagetian theory, for example, objects are pretexts for studying children’s individual competencies; they are not taken into account as social and historical entities. Being able to use them reveals the stage of thinking reached by the child. Other authors, however, have stressed the need to take objects and, more broadly, all mediations (material or conceptual) into account in order to understand where knowledge comes from (Baucal, 2012; Perret & Perret-Clermont, 2011; Sørensen, 2009). This is also the case in the CHAT (Cultural Historical Activity Theory) perspective

(Cole & Engestrom, 1995; Cole 1996; Engestrom, 1987). Following Vygotsky, these authors assign a central role in learning situations to social interactions in which students and teachers have the opportunity to reflect on their problem-solving strategies by engaging in a reflexive written or oral activity. In this perspective, activities that use intermediate artefacts to support social interactions are central in the meaning-making process. One such artefact is Digalo³, a software designed by researchers in psychology, education, communication and computer sciences to support argumentation in learning science. The underlying assumption was that debate and argumentation in class might become thinking tools that enhance learning. One of the aims of this research was to invite children to engage in scientific debates, as practicing scientists do, relying on the appropriation of concepts and the use of valid resources (for a detailed presentation of the role of the software, see Andriessen, Baker & Suthers, 2003; Muller-Mirza & Perret-Clermont, 2008). Drawing on Vygotsky’s thesis that thinking is semiotically mediated (Vygotsky, 1978), we hypothesized that the external representation of dialogues in argumentative maps (Digalo) could transform exchanges in the three school grades studied and thereby help to co-construct shared knowledge or ideas.

The originality of the Escalate research project conducted in Toulouse (France) was to propose this tool in an elementary school in order to study how teachers and their students used it to achieve a scientific understanding of the seasons. Three different grades took part in the research (Grades 3, 4 and 5) working on the cycle of seasons and the day/night cycle. We present here only part of the research project – the way children and their teacher co-constructed a shared understanding of the phenomenon of seasons by analysing the mediations used. We first present some theoretical underpinnings of the study, then the methodology used and

² According to Vygotsky’s definition, scientific concepts emerge during adolescence.

³ Digalo was developed in the Dunes project IST-2001-34153 and was tested in Escalate (Enhancing Science Appeal in Learning through Argumentative inTEraction) in science learning.

the main results regarding the role of Digalo maps in the teaching-learning situations.

Reasoning in astronomy

Naïve or everyday knowledge versus scientific knowledge

In developmental psychology, studying children's initial knowledge in astronomy is based on the identification of the naïve knowledge they have of the world. Vosniadou, Skopeliti & Ikospentaki (2004) showed that 6- to 12-year-old children's naïve representations about the shape of the Earth evolved as a function of different models: the first models represented the Earth as a disc or rectangle whereas the final model matched the scientific one, i.e. a spherical representation of the Earth. Between these two extremes were intermediate models that integrated new knowledge acquired in class into the initial or naïve knowledge. Children appeared to have a sort of naïve theory about the shape of the Earth, based on two presuppositions: "what looks flat is flat" and "what is not held up, falls down". In this cognitivist perspective, the focus is on the organisation and structuration of knowledge and its evolution during development. This perspective, often designated as conceptual change, tries to explain the difficulties met by children and adults based on their cognitive functioning. According to this theory, this intra-individual level of analysis could explain the difficulties people encounter in understanding a scientific phenomenon.

Another perspective consists in reconsidering the distinction made by Vygotsky between everyday concepts and scientific concepts and in redefining developmental psychology as a psychology of education or a psychology of teaching-learning situations and not only of an individual subject working alone. Schoultz, Säljö & Wyndhamn (2001) showed, for example, that it is necessary to take not only discourse practices seriously into account but also artefacts such as the globe in order to understand how

children reason and develop their reasoning regarding the Earth. Most of the time, except in situated and distributed approaches to cognition (Hutchins, 1995; Lave, 2011), these constructions have been studied in a decontextualised manner, that is to say outside the discursive and mediated activities in which they were constituted.

The present study adopts a Vygotskian approach, which posits that the activity of thinking and its dynamics or movements cannot be studied independently from the social, material and semiotic context from which they emerged (Moro, Schneuwly & Brossard, 1997). This is in line with the idea of a "semiotic ecology" (Enyedy, 2005) where talk, gestures, texts, graphics as well as body postures, material environment and history are taken into account (p.432). In order to understand the meaning-making process of a phenomenon, it is necessary to take seriously into account both materiality and semiotic tools as resources that can be the stage for another resource (p.432). In a sense, like Latour's (1987, 1988) definition of science as an argumentative social process that is never stabilized, a process of constructing, defending and challenging arguments about the nature of the world is used here. His proposition of mapping controversies (*cartographie des controverses* in French) in science seems to be both a methodology to learn about the complexity of scientific issues and a semiotic system to represent the links or networks between the different viewpoints of the actors involved in the process of doing science. Digalo allows users to construct maps of dialogues and thus supports doing science dialogically by visualizing the ongoing discussion about a scientific phenomenon. Studying argumentative maps in practice in different classes will illustrate whether or not this kind of tool supports the meaning-making process for students.

So following Latour, if doing science means engaging in argumentation for practicing scientists, children who learn to practice science need to learn how to construct, negotiate, defend and challenge

arguments (Danish & Enyedy, 2015). The developmental literature in psychology showed that children as young as three years old are able to provide justifications for their actions (Dunn & Dunn, 1987). Later, they also become able to adapt their justifications to the audience and the context (Orsolini, 1993). As we discussed elsewhere (Muller-Mirza, Perret-Clermont, Tartas & Iannacone, 2009), argumentation is a socially and culturally situated activity. Children learn to argue in everyday contexts and also learn to argue differently at school depending on the topic under study. Doing astronomy can be defined as participating in a social dialogical process with partners who do not always share the same background, knowledge and theories, where negotiations are at stake using different kinds of cultural resources. In the next part, we will explore the role of mediations in such a learning process.

Learning from social situations through computers

Learning has been defined in a situated perspective as learners' participation in inquiry- and discourse-based activities in science that bring together social interactions and the technological, material and symbolic resources available in the environment. Learning processes are not determined but are shaped by the social and physical affordances of the systems used by learners. Disagreements and their resolution, socio-cognitive conflicts (Baucal, Arcidiacono & Budjevac, 2013; Doise, Mugny & Perret-Clermont, 1975; Perret-Clermont, 1979/2000) and verbal exchanges (Jaubert, 2007) play a central role in learning. Argumentation in class is also a discursive activity that leads to learning and knowledge development (Andriessen, Baker & Suthers, 2003; Douaire, 2004; Muller-Mirza & Perret-Clermont, 2009).

Research in CSCL (Computer Supported Collaborative Learning) has shown that technological, material, and social resources shape how users

think about technology. As a result, software developers design interfaces that are intended to structure social interactions as they can generate learning for the users and orient the structuration of the argumentation. The software provides visual support for the discussion through the construction of argumentative maps or discourse maps. The externalisation of arguments and claims in a visual representation of knowledge has both advantages and constraints for debating and learning. These argumentative maps were first used as a means of communication or as a way of recording argumentative exchanges and then they became resources (both stimuli and guides) for conversation and reasoning (Roschelle, 1994). Suther (2003) showed for example how different computer-based representational shapes allowed the construction and manipulation of external representations that mediated collaborative interaction, a process he referred to as *representational guidance*. These representational tools provided the learners with the means of sharing their understandings and once shared, their understandings became open to question and usable by everyone taking part in the discussion. They became part of a shared context as objects of knowing. Representational guidelines play three main roles according to Suthers (2003, p.31): (1) they can initiate negotiations on the meanings at stake in the debate. For example when learners want to transform one representation or add a new idea they are obliged to agree with each other, which leads to negotiations about the representations used; (2) like deictics in writing, they have a deictic function since their components (i.e., arrows) make it possible to refer to what has been proposed earlier. An agreement or disagreement between two ideas or arguments can be pinpointed by using arrows to link two different shapes in the graphical discussion; (3) they provide a foundation for an explicitly shared awareness or a collective memory (p.31); shared representations may serve as memories for the group and they become always accessible for future exchanges.

As the present research concerns elementary school pupils and not more advanced students as is usual in CSCL studies, not all the functionalities of Digalo were used by the teacher and students. Thus, the shapes denoting different language acts were reduced to two or three: one for saying “I have an idea” or “I have a question...” and one for saying “I have a hypothesis” but in fact these shapes were used differently by the users. What serves as mediational means in our study is not the fact that shapes mediate different statuses of knowledge (such as hypothesis, argument, belief, question, counter-argument, etc.), it is rather the possibility of tracking the main ideas written in undifferentiated shapes and the possibility of going back to earlier elements in the conversation that serves as a tool to think about and explore in depth the problem under study. So writing her/his own idea, sharing it with others, questioning it, justifying it and trying to defend it or reviewing it depending on the different points of view and exchanges may lead students to develop a better understanding of the seasons. Suther (2003) pointed out that the units of knowledge made visually salient in the representational space become a more important object of negotiation than the units that were not challenged, discussed and linked to others.

Based on the thesis of the semiotic mediation of the mind, we hypothesized that participating in a debate mediated by Digalo followed by a reflexive step on the argumentative maps considered as a product or intermediate state of thinking (the maps were printed and read and examined by the students and their teacher), can be conducive to learning in science. A great deal of research in CSCL has shown the benefits of synchronous sessions with argumentative tools but very few studies have examined how the argumentative map as a process of meaning-making can become a product from which another thinking activity may emerge between students and their teacher. What kind of practices take place when the teacher uses Digalo in an elementary astronomy class? To answer this question, we monitored the way children and teachers used Digalo

in the course of different kinds of learning activities aiming at helping students to acquire a “scientific culture”, i.e. to be able to propose a hypothesis, to discuss it with others in order to improve it, and to use acceptable and evaluable sources to support their viewpoint.

We focused mainly on the transition from a collaborative dialogical written activity – synchronous debate through an argumentative map - to another collective dialogical activity directed by the teacher and mediated by a printed argumentative map on which students were invited to assess the argumentation and the knowledge used. We assumed that this space of negotiation, supported by argumentative maps in both synchronous and asynchronous (afterthought traces of activity) use, and guided by the teacher would lead to a reflexive activity about knowledge and argumentation. It is not only the semiotic activity based on this kind of map that generates such a reflexive posture but the combination of these varying forms of work guided by the teacher that can lead to such an inquiry attitude towards others’ and towards their own ideas.

METHODOLOGY

Participants

Three grades in an elementary school in the suburb of Toulouse participated in the study: 25 grade 3 students and their teacher, 23 students in a double grade (grades 4 and 5) and their teacher, and 28 Grade 5 students and their teacher. Different artefacts (language as well as various semiotic tools such as maps, tables, gestures, etc.) were used to answer the question: why are there seasons? Teachers and researchers co-constructed the class sessions and chose the different tools distributed to the students in order to support the scientific approach based on the emergence of conflicts or contradictions at different steps in the learning process.

Material

The students took part in the activity ‘doing astronomy’ by following different sessions in the learning sequence in which various resources were proposed: a scientific figure representing the distance between the Earth and the sun at the different equinoxes; the uses of the software Digalo. The teachers and the students also used the blackboard and a globe. During the small group sessions, the students used their notebooks to write down explanations that completed/supported their verbal exchanges.

We focus particularly on (a) the argumentative maps in-the-making (in synchronous session) as the visualization of the discussion in order to represent different points of view and their relations; (b) the printed argumentative maps as specific meditational tools (tool of the tool in a sense) because they can be used as discursive tools to support an initial understanding of the object –seasons- and as a discursive product when they become an object for a new activity (evaluation of the propositions in the map).

The learning situation and the unit of analysis

A learning sequence comprised several sessions during which different activities were proposed in order to see whether or not students can engage in an inquiry- and argumentation-based approach to science. These activities - formulating a hypothesis, explaining seasons using different documents, debating in class, debating with Digalo, re-using a collaborative work materialized on an argumentative map in order to start a new debate - were studied as mediated actions in context (the unit of analysis suggested by Cole, 1996). The analyses of these different actions concern two planes of cognition: a plane with an analysis of the dynamics of argumentation (Argument[^]Reply[^]Counter-Argument, Leitao 2000) and a conceptual plane, the di-

mension of meaning-making of the phenomenon “seasons”. But as these mediated actions are guided by the teacher, the processes of argumentation and of co-constructing meanings of the seasons were also studied with respect to the teacher’s actions and in particular how the teacher scaffolded students’ argumentative and conceptual activity.

Figure 1 presents the different steps of the learning sequence. (1) In the first phase, students were asked to answer different questions about astronomy in order to assess their comprehension of the seasons and of the day/night cycle, etc. (2) In the second phase, small groups of four students (with different levels of understanding, based on the results of the questionnaires in phase 1) had to write hypotheses to explain “why is it hotter in summer than in winter?” after having worked together on a figure representing the distance from the Earth to the sun. (3) The third phase consisted of a whole-class debate on the question “why are there seasons?” as a point of departure and in which all the groups put forward their hypotheses that had been formulated in the previous phase. (4) A debate through Digalo then took place, initiated by a question or a proposition, which was not the one on which there was a consensus in the small groups in phase 2. (5) The fifth phase was a map-oriented discussion in small groups (the same during all the phases): two reconstructed maps based on the maps developed in phase 4 were proposed in order to initiate another debate. (6) A final collective debate based on these two argumentative maps was orchestrated by the teacher. (7) Students were individually asked the same questions as in phase 1, as a sort of post-test (even if it can also be defined as a learning phase as we discussed elsewhere; see Tartas & Perret-Clermont, 2012; Tartas, Baucal & Perret-Clermont, 2010). All of these steps were videotaped and transcribed. In this article, we will focus mainly on the fourth phase (in which the maps were produced by the students) and on the following phases where they were re-used. The analysis of the last collective debate (step 6) has been reported elsewhere (Tartas & Simonneaux, 2015), so

will not be presented here in detail. Rather, we used the epistemic obstacles identified in this first analysis (Tartas & Simonneaux, 2015) as indicators to study the co-construction of the scientific meanings of the seasons through several argumentative sessions (from 2 to 5). We focused our analysis mainly

on some of these “epistemic obstacles” such as the movements of the sun/the movements of the Earth, the tilt of the earth/ the angle of the sunbeams, the “speed” of the Earth (the fact that the Earth can rotate faster or more slowly).

Phase	Nature of the task	Data
1. Individual work (pre-test)	To explain the planets' moves, seasons, day and night cycle...	First written production
2 (a) collective in the class 2. (b) collective work in group of 4 (heterogeneous)	Initial question + first explanations Putting forward a hypothesis (distance document)	oral exchanges in the class and within small groups (video-recorded) + written production (joint hypotheses)
3. Collective debate in class – joint setting	To confront groups' hypotheses to outline the diversity of explanations	Oral exchanges in class (video-recorded)
4. Digalo session in group of 4	To debate from another hypothesis than the one proposed	Written exchanges on digalo + oral exchanges (video-recorded)
5. Small group on maps	To evaluate two argumentative maps	Oral exchanges (video-recorded)
6. Collective in the class	Debate on the maps	Oral exchanges (video-recorded)
7. Individual work (post-test)	Same as 1	Written production

Figure 1. The different phases of the learning sequence regarding the nature of the task and the kind of data.

Results

General results (comparison of phases 1 and 7)

The analysis of the students' answers to the questions concerning their knowledge about the solar system (first and last phases of the learning sequence) led to the conclusion that the grade 5 students and the double 4th and 5th grade students im-

proved their knowledge about the seasons (comparisons of scores between pre- and post-tests: grade 5: $t=2.585$, $p=0.017$ and grade 4-5th: $t= 2,750$, $p=0.010$). More particularly, the most frequently used argument in phase one (the distance) to explain the fact that it is hotter in summer than in winter, was less frequent in the last phase for these two grades. Only the 3rd grade students did not progress

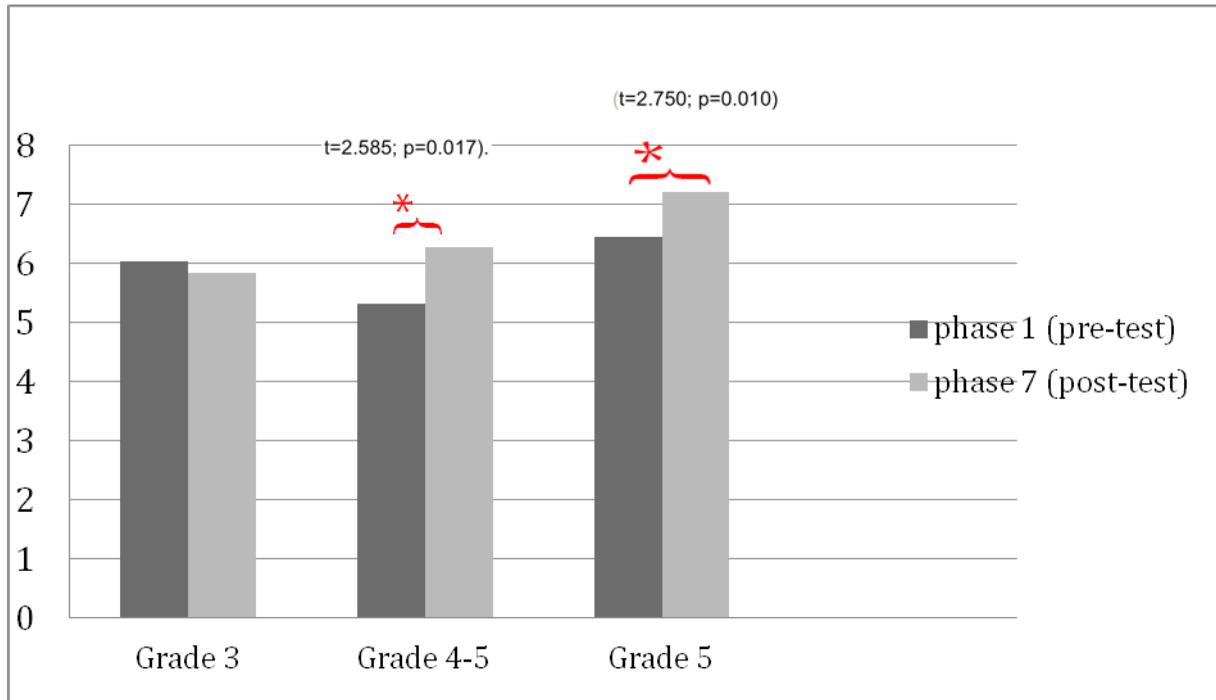


Figure 2. Evolution of the score of understanding the seasons from pre-test (phase 1) to post-test (phase 7)

between phase 1 and phase 7. However, this general analysis tells us nothing about what happens during the different argumentative phases of the learning sequence. We therefore undertook more detailed analyses to examine (a) the different hypotheses proposed by the groups of students in the three elementary grades; (b) the way they discussed them through argumentative discussion online (Digalo session phase 3); (c) the way the 5th grade teacher and his class co-constructed a shared explanation of the seasons by using the argumentative maps.

Different kinds of hypotheses depending on the school grade

If we examine first the hypotheses proposed by the students after phase 2, where they worked in small groups of four students on a scientific document (a figure representing the distance from the sun to the Earth at the different equinoxes) and

after the first whole-class debate (phase 3), it was the hypothesis of distance that was preferentially used by the students even though they had a document that directly contradicted this proposition. This contradiction, deliberately introduced by the teacher, did not achieve the intended effect from the students' perspective as they did not use it at the beginning of the learning sequence.

The 3rd grade students proposed two hypotheses: (a) the Earth goes faster in winter than in summer and (b) the Earth is nearer the sun in summer.

The 4-5th grade students proposed two hypotheses: (a) the Earth is nearer the sun in summer and (b) the days are shorter in winter because the Earth is tilted.

The 5th grade students developed four hypotheses: (a) summer is due to the fact that the Earth approaches the sun; (b) half of the Earth is lit

by the sun and the other half not; (c) the hot season is due to the fact that the sun is higher; (d) the sunbeams arrive straight on the Earth in summer.

Examples of argumentative maps at the three elementary school levels

These different hypotheses were re-used to initiate the debate via Digalo software in phase 4: the students discussed in pairs via the software in the same small groups as those initially formed in phase

2. Three examples of argumentative maps are shown to illustrate the kinds of maps elaborated by the students as a function of their grade (see Figures 3, 4 and 5). We analysed the maps using Leitaos' (2000) patterns of Claim^Counter-Claim^Reply in order to shed light on argumentative dynamics and we also tried to identify the different themes proposed and negotiated during the various debates.

The way 3rd grade students used Digalo is specific: they did not justify their propositions and sim-



Figure 3. Example of an argumentative map in grade 3 (phase 4)

Legend: translation of the map

1. The Earth turns faster in winter than in summer that's why there are seasons
2. we don't know
3. why do seasons exist?
4. seasons are needed to make the plants grow
5. It should be summer everyday.
- 6.
7. we need seasons because it would not be funny if it is always hot.

ply juxtaposed their ideas without linking them up. Furthermore, whatever the hypothesis proposed, as here in figure 3 “the Earth goes faster in winter than in summer, that's why there are seasons”, grade 3 students proposed functional explanations such as “seasons are necessary to make plants grow!” This

proposition was not challenged or taken up as an object of discourse. Each of the participants in the debate wrote a proposition without any link with what had been previously proposed.

In the 4-5th grade, the argumentative maps were not more fully developed than in the 3rd grade

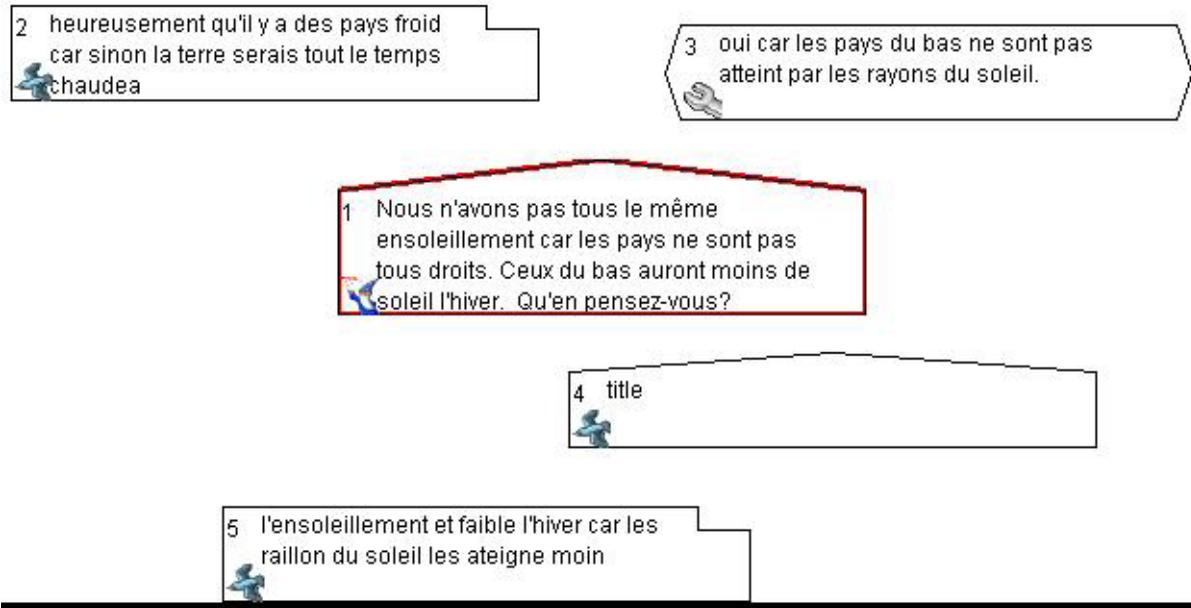


Figure 4. Example of an argumentative map in the 4-5th grade

Legend: translation of the map

1. We do not have the same sunlight because not all countries are straight. The ones in the bottom will have less sun. What do you think about that?
2. fortunately there are some cold countries otherwise the Earth would always be hot.
3. yes because the sunbeams can't reach the countries at the bottom .
4. -
5. the sunlight is weak in winter because the sunbeams reach them less.

but the students tried to answer the question that can be reformulated as: what are the origins of the seasons? The initial hypothesis presented in figure 4 was “we do not all receive the same amount of sunlight because the countries are not all straight on. The ones that are at the bottom have less sun in winter” (see figure 4, number one). This hypothesis was not taken into account by the students but they tried to answer why there are seasons or they tried to justify their proposition. In another argumentative map, the following hypothesis “the days are shorter in winter because the Earth is tilted” was challenged, with opponents “I think it is wrong because in that case the days would also be longer in summer” and

defenders “we think it is true because the sun rises later in winter and sets earlier”. Answers at this level begin to be justified and co-exist with propositions that are juxtaposed.

In Figure 5 there are seventeen propositions, some linked by arrows. The format of the discussion through Digalo was rather Claim[^]Counter-Claim[^]Reply (Leitao 2000; Muller-Mirza, Tartas, Perret-Clermont, & De Pietro, 2007). The students engaged fully in a sort of evaluative process about what had been said and why. They asked questions when it was not clear or when they needed further information. Argumentative maps become richer in quantity and quality as the school level increases.

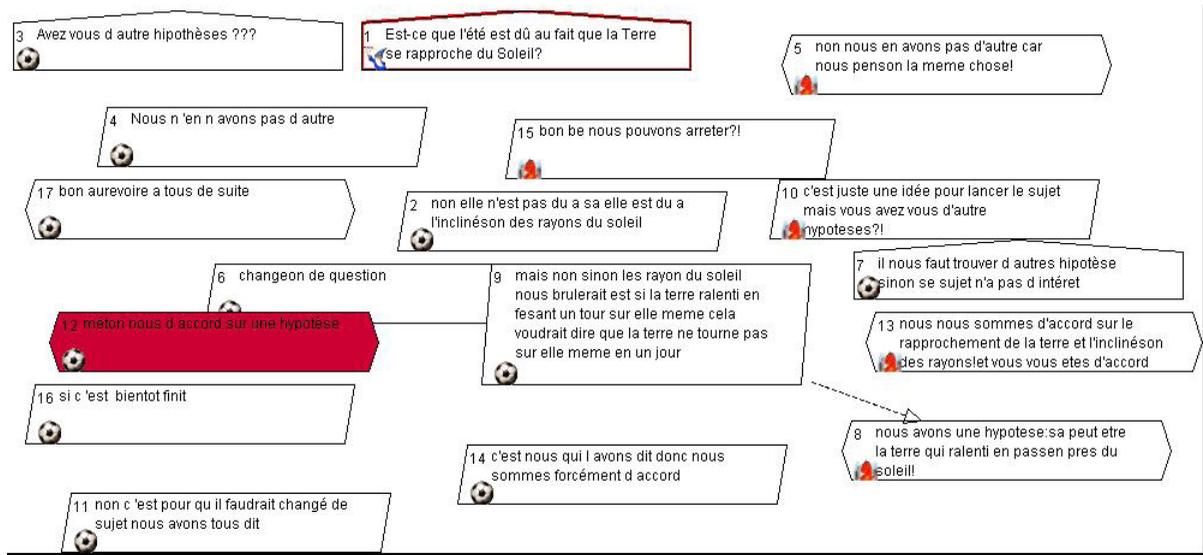


Figure 5. Example of an argumentative map in the 5th grade

1. Is summer due to the fact that the Earth is nearer the Sun?
2. No, it is not due to the Earth but it is due to the angle of the sunbeams
3. do you have any other hypotheses?
4. We do not have any
5. no we do not have any because we think the same.
6. let's have another question
7. we have to find other hypotheses otherwise the subject loses its interest
8. we have a hypothesis: maybe the Earth slows down when it is near the sun.
9. But no otherwise the sunbeams would burn us and if the Earth slows down when it rotates on itself it means that the Earth rotates on itself in one day.
10. it is just an idea, do you have any other hypothesis?
11. no we could change our subject we have already said everything.
12. let's agree together on a hypothesis
13. We agree about the Earth moving closer to the sun and the angle of the sunbeams and you, do you agree?
14. It is our proposition so of course we agree!
15. so we stop
16. yes it is nearly the end
17. goodbye see you soon!

As a conclusion, the argumentative maps were not used in the same way in the three grades: it is only in grade 5 that the students engage in the dialogical dynamics of argumentation supported by Digalo where they followed the other participant's proposition, tried to agree with it or dismiss it. Some of the students in grade 4-5 and grade 5 seem to have learnt not only about the topic at stake through

the different debates (small group, whole group, Digalo debate) but also to have learnt about argumentation. When only the structure of the argumentative exchanges is analysed, it is found that the grade 5 students proposed more coordinated propositions in their discussion and their propositions are also better linked and justified. Their justifications relied on scientific proof as well as on an appeal to authori-

ty (discourse of parents, teachers, etc.) or they asked their partner to develop their viewpoint.

After having participated in this phase of discussion through Digalo, the argumentative maps produced by each school grade were re-used and re-built in order to give students the opportunity to re-use the collective debate in another activity. Two argumentative maps were constructed by the researchers in order to confront the students' knowledge about the quality of the arguments proposed in the map and the knowledge mobilized to generate the discussion: one argumentative map was a "poor" map with regard to both argumentation and knowledge mobilized, while the second map was "rich" in that opposite arguments were proposed, propositions were justified and coordinated. The students from each grade received the following instruction: read the two maps and evaluate the content and the argumentation first in the same small groups (step 5) and then discuss them in the whole-class group (step 6). It was during this last phase of debate guided by the printed map, and in particular when they examined the richer one, that the 5th-grade students engaged in a more reflexive activity and dismissed the distance explanation for the seasons.

Examining one teacher's scaffolding actions to enhance argumentation in astronomy

The teacher of the 5th grade initiated this reflexive activity mediated by the reprinted maps. He first asked the students to work with the poor map. What was the scaffolding proposed by the teacher?

Excerpt 1: the teacher's scaffolding: towards the construction of a shared dialogical space

1. Teacher. (The teacher proposed the following activity to the students) So you will look at ... we will see what happened when you exchanged: did it go well? Are there some elements that are not good? Try to review the conversation, try to understand it. You will tell me what goes well and what is not good, are the arguments good ones or not? Are they delivered at the right moment in the discussion? Do they add something new to the debate or not? You can

write on these papers if you want if you see elements that are worth discussing you can underline them, discuss them together...

2. Teacher: so we begin < he reads in a loud voice> the sunbeams arrive straight on the Earth in summer and that's why it is hotter in summer than in winter. What do you think about that? What sort of questions do you ask yourself? Can you remember what your hypotheses were?

A discussion began between some students and the teacher about what makes a good argument and the fact that it needs to be justified.

3. a student: (A student reads a proposition from the printed map) "but how is it possible to have more time to make a larger trajectory" (concerning the sun) and added: "it is not a good argument this one, it is a question!"

4. group of students (Then the students comment on the propositions in the poor map and finally agree that): saying we agree with this or that proposition is not a sufficient element to talk about argument or justification.

5. Another student: it is Clement's hypothesis!

6. The teacher (sums up and reformulates what happened): they asked a question and they developed another hypothesis so they began with a question and they did not find arguments they said yes, yes, it is true but even if it is true it is necessary at a certain point to say why it is true that the sunbeams arrive straight on the Earth but if you haven't got any arguments... You have no proof, "we agree with that" does not further the debate.

7. The students approved.

8. A student: the sun does not make a trajectory.

9. The teacher: the sun does not make a trajectory; yes so why did they propose that the sun did make a trajectory?

10. Another student: we have to speak about the Earth rather.

11. The teacher concluded: so it is to show you that in this map there is no argument in the debate it is difficult to draw conclusions when there is no argumentation and no debate in fact... so here's another map and I want you to discuss this map together in small groups and then tell me if the arguments are good ones. Do they arrive at the right moment? Or not? etc., etc. Discuss this map together for five minutes and then we'll discuss it all together.

In excerpt 1, the scaffolding proposed by the teacher relies on reformulation and making explicit the work that has to be done both conceptually (for example when he asked "why did they propose that the sun did make a trajectory"; excerpt 1, 9) and dialogically or argumentatively (excerpt 1, 11). He tried to lead the students to confront their knowledge about whether it is the Earth or the Sun that moves and their relations. By asking questions or asking for clarification, he co-constructed with them a common background to examine the seasons. Progressively the students engaged in a debate on the sun's apparent movement and the fact that only the Earth moves. Later they examined the movements of the Earth: does the Earth tilt ("*bascule*" in French)? and then the speed of the Earth (speed of rotation or revolution?) as possible ways to explain the seasons. The teacher's reformulations and clarifications lead the students to construct a shared space of discussion and allow them progressively not to find one answer but to dismiss unsatisfactory ones. Once this space has been co-constructed, the teacher provides another form of scaffolding by letting them work in small groups: peer-work mediated by the map.

The teacher led the students to be able to co-construct criteria to evaluate the others' explanations; these criteria became shared rules for the group and sometimes for the class community when the students presented them in the whole class debate and when the teacher focused on them and asked for discussion.

Discussion

Results showed that elementary students guided by their teacher are able to use argumentative maps in order to engage in a discursive practice of science, in this case astronomy. Most research has focused on more advanced students so it is interesting to see that elementary school students and particularly 5th grade students begin to engage in dialogical uses of mapping the different explanations of the seasons. Through oral dialogues and dialogues mediated by argumentative maps and by the teacher's scaffolding, they progressively scrutinized the different explanations as well as the ways of expressing them in a debate. Participating in an argumentative map construction to learn about the seasons seems to be more difficult for grade 3 students. The argumentative strategies used in the argumentative maps at this level consist in juxtaposing ideas rather than being able to challenge them. Subsequently, in grades 4-5 and grade 5 as the argumentation develops, the maps become richer in challenges and progressively the distance hypothesis is sidelined in their explanation of the seasons. Grade 5 students progressively engage in a more co-constructive way of negotiating meanings from a scientific perspective during the learning sequence. Participating in mapping the seasons dialogically is also transforming: from a simple inscription or projection of an idea and another one, etc. in a common space, it becomes a way of negotiating meanings with respect to certain norms that are also negotiated. The results regarding the teacher's scaffolding indicate that scaffolding intervenes at several levels. The teacher scaffolds the development of students' understanding by arranging socially and materially (Sørensen, 2009; Kontopodis & Perret-Clermont, in print) the conflict or the tension between their level of "actual" development and the one they have to reach – the potential one (Vygotsky's (1933/1997) distinction between actual level of development and the potential one): first when he proposed a scientific schema that contradicted the most common hypothe-

sis about the seasons (the distance one), then when he organised the peer groups with different levels of understanding of the seasons, when he confronted the peer group with another hypothesis than the one they agreed on in order to generate a new debate through Digalo argumentative maps, and also when he proposed to compare two maps as a possible way of generating another understanding and brought the students to agree on specific rules to develop a better argumentative discussion.

Conclusion

The research presented here provides different aspects of learning-teaching in innovative ways.

References

- Andriessen, J. Baker, M. & Suthers, D. (2003). *Arguing to learn: confronting cognitions in computer-supported collaborative learning environments*. Dordrecht: Kluwer Academic Publishers.
- Brown, J.S., Collins, A. & Duguid, P. (1989). Situated Cognition and the Culture of Learning, *Educational Researcher*, 18 (1), 32-42.
- Baucal, A. (2012). Scaffolding by design: Co-construction through interaction with culturally structured environment. In: Baucal, A. & Radišić, J. (Eds.), *Patchwork. Learning Diversities - conference proceedings (full papers)* (pp. 71-79). Belgrade, Institute of Psychology.
- Baucal, A., Arcidiacono, F., & Budjevac, N. (2013). "Is there an equal (amount of) juice?" Exploring the repeated question effect in conservation through conversation. *European Journal of Psychology of Education*, 28(2), 475-495.
- Bruner, J. (1996). *L'éducation entrée dans la culture*. Paris : Retz.
- Cole, M., & Engestrom, Y. (1995). Commentary. *Human Development*, 38(1), 9-24.
- Cole, M. (1996). *Cultural Psychology: A once and future discipline*. MA: Cambridge University Press.
- Danish, J.A. & Enyedy, N. (2015). Latour goes to kindergarten: children marshaling allies in a spontaneous argument about what counts as science. *Learning, Culture and social interaction*, 5, 5-19.
- Doise, W., Mugny, G., & Perret-Clermont, A.-N. (1975) Social interaction and the development of cognitive operations, *European Journal of Social Psychology*, 5, 367-383.
- Douaire, J. (Ed.) (2004). *Argumentation et disciplines scolaires*. Paris : INRP.
- Dunn, J. & Munn, J. (1987). Development of justification in disputes with mother and sibling. *Developmental Psychology*, 23(6), 791-798.
- Engestrom, Y. (1987). *Learning by expanding. An activity theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.

Firstly, it has studied the way argumentative maps can be used to enhance learning and teaching science in elementary school, a topic that has seldom been studied in the literature. Secondly it has highlighted the need to define teaching and learning activities as joint ones (and not to favour only the study of students' conceptual development apart from the teacher's actions). And it concludes by showing that providing students with opportunities for re-using their previous collective elaborations may be an interesting teaching innovation in order to foster their engagement in a reflexive activity.

- Engestrom, Y. (1990). Learning, working, imagining: Twelve studies in activity theory. Helsinki: Orienta-Konsultit.
- Enyedy, N. (2005). Inventing mapping: creating cultural forms to solve collective problems. *Cognition & Instruction*, 23(4), 427-466.
- Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.
- Jaubert, M. (2007). *Langage et construction des connaissances à l'école*. Un exemple en science. Bordeaux : Presses Universitaires de Bordeaux.
- Kontopodis, M. & Perret-Clermont, A.-. (2015, in print). Educational Settings as Interwoven Socio-Material Orderings: An Introduction. *European Journal of Psychology of Education*, 30(4).
- Latour, B. (1987). *Science in action: how to follow scientists and engineers through society*. Cambridge, MA : Harvard University Press.
- Latour, B. (1988). Drawing things together. In M. Lynch & S. Woolgar (Eds.), *Representation in scientific practice* (pp. 19-68). Cambridge, MA: MIT Press.
- Lave, J. (2011). *Apprenticeship in Critical Ethnographic Practice*. Chicago: Chicago University Press.
- Moro, C. Schneuwly, B. & Brossard, M. (Eds.) (1997). *Outils et signes. Perspectives actuelles de la théorie de Vygotski*. Berne: Peter Lang.
- Muller-Mirza, N., Perret-Clermont, A.N., Tartas, V. & Iannaccone, A. (2009). Psychosocial processes in argumentation. In N. Muller-Mirza & A.N Perret-Clermont (Eds.) *Argumentation and education* (pp.67-90). London: Springer.
- Muller Mirza, N. & Perret-Clermont, A.- N. (2008). Dynamiques interactives, apprentissages et médiations : analyses de construction de sens autour d'un outil pour argumenter. In L. Filliettaz & M.-L. Schubauer-Leoni (Eds.) *Processus interactionnels et situations éducatives*. Bruxelles: De Boeck collection Raisons éducatives.
- Muller Mirza, N., Tartas, V. Perret-Clermont, A.-N. & De Pietro, J.-F. (2007). Using graphical tools in a phased activity for enhancing dialogical skills: an example with Dunes. *International Journal of Computer-Supported Collaborative Learning*, 2 (2-3), 247-272.
- Perret, J.F. & Perret-Clermont, A.-N. (2011). Perret, J.-F., & Perret-Clermont, A.-N. (2011). *Apprentice in a changing trade* (N. Emler, Trans.). Charlotte, N.C. USA: Information Age Publishing.
- Perret-Clermont, A.-N. (1979/2000). *La construction de l'intelligence dans l'interaction sociale*. Berne : Peter Lang.
- Orsolini, M. (1993). "Dwarfs do not shoot": an analysis of children's justifications, *Cognition and instruction*, 11 (3-4), 281-297.
- Resnick, L.B. (1987). Constructing knowledge in school. In L. S. Liben (Ed.), *Development and learning: conflict or congruence?* (pp. 19-50). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Roschelle, J. (1994). Designing for cognitive communication: epistemic fidelity or mediating collaborative inquiry? *The electronic journal of virtual culture*, 2(2).
- Schoultz, J., Saljo, R., & Wyndhamn, J. (2001). Heavenly Talk: Discourse, Artifacts, and Children's Understanding of Elementary Astronomy. *Human Development*, 44, 103-118.
- Siegal, M., Butterworth, G. & Newcombe, P.A.(2004). Culture and children's cosmology. *Developmental Science*, 7 (3), 308-324.

- Suthers, D.D. (2003). Representational guidance for collaborative inquiry. In J. Andriessen, M. Baker & D. D. Suthers (Eds.) *Arguing to learn. Confronting cognitions in computer-supported collaborative environments* (pp.27-46).. Dordrecht : Kluwer Academic Press.
- Tartas, V. & Perret-Clermont, A.-N. (2012). Faire avec autrui une situation pour comprendre le développement. In Y. Clot (dir.), *Vygotski maintenant*. Paris: La Dispute.
- Tartas, V., Baucal, A. & Perret-Clermont, A.-N. (2010). Can you think with me? The social and cognitive conditions and the fruits of learning. In C. Howe & K. Littleton (Eds.), *Educational Dialogues: Understanding and Promoting Productive Interaction* (pp.64-82). London: Elsevier Advances in Learning and Instruction Book.
- Vosniadou, S., Skopeliti, I. & Ikospentaki K. (2004). Modes of Knowing and Ways of Reasoning in Elementary Astronomy. *Cognitive Development*, 19, 203-222.
- Vygotski, L. S. (1931/1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Vygotski, L.S (1934/1985). *Pensée et Langage*. Paris: Editions sociales.

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Учење природних наука помоћу дијалогских мапа

Развој дејјих појмова се још увек проучава без узимања у обзир школских активности, пре свега, вербалних и инструменталних, у оквиру којих се ови појмови развијају. Ово истраживање се базира на виђењу Виготског, који дефинише мишљење и његову динамику у оквиру семиотског контекста у којем се мишљење одвија. Овај рад има за циљ да покаже како је наставник уводио ученике у усвајање учења природних наука на начин који је истраживачки и аргументован. Развијен је софтвер који подржава аргументацију и учење – аргументативна мапа која се зове Дигало, и којом се обезбеђује визуелна презентација дискусије, а користили су је ученици и наставници у учионици за учење о астрономији. Дигало допушта корисницима да конструишу мапе дијалога и тако визуализацијом дискусије која је у току, а у вези је са научним феноменом, подрже рад из природних наука. Проучавање аргументативних мапа у пракси на различитим часовима ће илустровати да ли ова врста оруђа подржава процесе ученичког разумевања и учења. Бављење астрономијом може да се дефинише као учествовање у друштвеном процесу са партнером који нема увек исто порекло, знање и теоријску подлогу, и где преговарање не мора да буде успешно због различитог културног порекла.

Подаци који су овде приказани узети су из Европског пројекта (Escalate), који има за циљ да обухвати учење природних наука кроз аргументацију и активности истраживања. (Andriessen, Baker & Suthers, 2003; Muller Mirza & Perret-Clermont, 2008; Muller Mirza, Tartas, Perret-Clermont & De Pietro, 2007). Три разреда основне школе (трећи, четврти и пети) учествовала су у овом истраживању и задатак је био да објасне зашто постоје годишња доба током различитих фаза дебате које је водио наставник и које су биле потпомогнуте аргументативним мапама.

Општи квантитативни резултати, засновани на поређењу резултата пре теста и после теста, показали су да су ученици четвртог и петог разреда унапредили знање, док ученици трећег разреда нису напредовали.

Детаљнија анализа различитих фаза истраживања је спроведена усредсређујући се на дечије разумевање годишњих доба кроз анализу њихових закључака (структуру аргументованог садржаја аргументованих мапа) и како је наставник петог разреда посматрао сесије својих ђака. Резултати су показали да ученици основне школе могу да уче из дебата које су усмерене ка аргументованим мапама и које води наставник. О улози аргументативних мапа и ограничења које намеће наставник у процесу учења и мишљења се дискутују из социокултурне перспективе.

Истраживање које је овде спроведено приказује различите аспекте учења и поучавања на иновативне начине. Прво, проучавано је како аргументоване мапе могу да се користе да би се обухватило учење и поучавање природних наука у основној школи, тема о којој се није много дискутовало у литератури. Друго, наглашена је потреба да се дефинишу активности поучавања и учења као заједничке (а да се не проучава развој појмова код ученика независно од активности наставника). Закључак је да могућност да ученици имају прилику да поново користе заједничку елаборацију може да буде занимљива иновација у поучавању, а тако би се стимулисало и њихово учешће у рефлексивним активностима.

Кључне речи: учење природних наука, аргументација, семиотичка оруђа и медијација, аргументативна мапа.



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The role of argumentation in seven-year-olds joint comprehension of written text³

Abstract: Argumentation is a dialogical activity during which partners try to increase or decrease the acceptability of expressed ideas. It is considered as one of the main factors of development and learning through peer interaction, since several studies show that argumentative dialogues offer more opportunities for learning than other types of dialogues. Having in mind the importance of argumentation in the construction of new knowledge and individual development of seven-year-olds, the aim of this study is to understand how children use argumentation while reading together. Within a larger corpus of data (including 45 sequences) we have analysed ten sequences in which the divergence of opinions was resolved by the use of argumentation. The results show that at the considered age there are two different effects of argumentation use: (1) the acceptance of the standpoint supported by the argument; (2) the change in the way the joint activity is performed. In addition, we have found several indicators of argumentation use limitations connected with the difficulty experienced by the children to take the position of the partner, to coordinate different perspectives and to build collaboration. We conclude that joint work at the age of seven offers educationally relevant benefits, thus that it should be included in the classroom activities with continuous scaffolding provided by the teacher.

Key words: argumentation, symmetrical peer interaction, learning through interaction; reading together.

Introduction

Taking the perspective that cognitive processes are socially embedded, Vygotsky defines learning as a process of participation in a social process of knowledge construction rather than an individual

effort (Vygotsky, 1962; 1978). Following that idea, many scholars have studied and identified different factors that are relevant in terms of opportunities to learn and develop through interaction with others (e.g. Doise, Mugny & Perret-Clermont, 1975; Mugny & Doise, 1978; Doise & Mugny, 1979; Light & Perret-Clermont, 1989; Schwarz, 1995; Schwarz et al., 2000; Howe et al., 2007; Schwarz & Linchevski, 2007; Schwarz et al., 2008; Howe, 2010). Depending on the participants' age, type of interaction (sym-

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metrical/asymmetrical), goals of interaction, type of joint activity and so on, these factors and their influence on learning can vary. As the focus of this paper is symmetrical peer interaction between seven-year-olds, we will consider the factors especially relevant for development through interactions at this age.

Studies of symmetrical peer interaction are mainly focused on the conditions under which participants can jointly solve the tasks which they cannot complete individually (Ames & Murray, 1982; Schwarz et al., 2000). One of the key factors underlined in these studies is that through the joint work participants consider different ideas about the possible solution (Doise, Mugny & Perret-Clermont, 1975; Doise & Mugny, 1979; Light & Perret-Clermont, 1989; Schwarz, 1995; Schwarz et al., 2000; Howe et al., 2007; Schwarz & Linchevski, 2007; Howe, 2010). As the task they are solving together is above their individual competencies, starting with the same (possibly wrong) answer significantly lowers the possibility that partners will develop new understandings or skills through the joint activity (Tudge, 1992). In addition to this, it is necessary that partners critically consider expressed ideas, i.e. enrol in the argumentative exchange (Schwarz et al., 2000; Howe et al., 2007). This is in line with the idea about the importance of socio-cognitive conflict, introduced by Doise and colleagues (Doise, Mugny & Perret-Clermont, 1975). Developing further Piaget's idea about cognitive conflict as a factor of individual development (Piaget, 1995), Doise and colleagues argued that what develops during a social activity, at the level of interaction, leads toward individual cognitive reorganization. Thereby, the new understanding develops through the process of articulation, confrontation and coordination of actions. This means that the process of sharing is efficient no matter if the starting ideas are right or wrong (Light & Perret-Clermont, 1989; Kuhn et al., 1997), i.e. if the position of one partner is developmentally advanced or not. However, it is not enough that socio-cognitive conflict occurs, but it needs to be resolved. For that reason, argumentative discussion is one of the

main factors of new skills/knowledge development (Tudge, 1992; Schwarz et al., 2000; Limon, 2001; according to Schwarz & Linchevski, 2007; Light & Littleton, 2004; Schwarz & Linchevski, 2007; Schwarz et al., 2008; Asterhan & Schwarz, 2009; Howe, 2010; Muller Mirza et al., 2009).

In this paper, argumentation is considered as a dialogical activity during which the partners try to increase or decrease the acceptability of expressed ideas (Walton, 2006). It is based on the establishment of specific relations among discussed ideas and other sources of knowledge, which affect epistemological status of expressed ideas (Baker, 2002). Argumentation, thus, should not be considered only as a result of interaction, but as a process of negotiation (Kuhn et al., 1997; Arcidiacono & Perret-Clermont, 2009, 2010). Given the definition of argumentation we have just mentioned, it is clear why participation in argumentative discussion leads towards the (co)construction of new knowledge and competencies: interactions including argumentation put specific pressure on partners to precisely define their ideas (Baker, 2002), elaborate it and justify, which secures their engagement in different cognitive operations on the content they are working on. However, whether the partners will enrol or not in the process of negotiation depends on many different factors, such as the age of participants (i.e. level of cognitive and social development, cf. Muller Mirza et al., 2009), the way they understand the goal of the interaction or interpret the instruction (Grosen, 1994; Sorsana, 2008; Tartas & Perret-Clermont, 2008), different personal characteristics such as self-esteem (Tudge, Winterhoff & Hogan, 1996; according to Tartas & Perret-Clermont, 2008). Since the participation in argumentative exchanges depends on cognitive and social maturity (social and cognitive decentration, generalisation ability, cf. Muller Mirza et al., 2009), the use of argumentation at early ages is not stable and depends on contextual factors as well. For example, results of previous research reveal that children from 5 to 14 years old manage to participate in a more competent way in

argumentative discussions with an adult who is familiar to them than with a peer (according to Muller Mirza et al., 2009). This is in line with studies revealing how the competence to solve some problem relates to social factors, showing that by the complexity of the task the importance of contextual factors children rely on significantly increases (Siegal, 1991; according to Krstić & Baucal, 2003). Having in mind the importance of argumentative discussions for learning and development through peer interactions, these results open the issue of the effectiveness of symmetrical peer interactions at early ages. It also recalls the importance of detailed understanding of the way the context within children work together and the meanings they attribute to it support or limit their activity and opportunities for learning (Light & Littleton, 2004). Although there is a huge number of studies exploring the effects of different factors on the learning process and joint work achievements (Ames & Murray, 1982; Cohen, 1994; Schwarz et al, 2000; Fernández et al, 2001; Barron, 2003; Schwarz & Linchevski, 2007; Tartas & Perret-Clermont, 2008; Buđevac, 2013), all we know about this issue so far suggests that the process and effects of social interactions are somewhat unpredictable, which highlights its complexity and the need for further explorations. Numerous studies of symmetrical peer interaction show that even when the starting level of knowledge (or relevant skills development) and the instruction are equal, the process of task solving and the effects of the joint work could be very different (Salomon & Globerson, 1989; Barron, 2000; Hogan, Natasi & Pressley, 2000; Webb, Zuniga & Welner, 2001; Barron, 2003). This is exactly why it is often affirmed that it is not essential to put children to work together, but it is necessary to create the opportunities that certain learning processes are activated (Cohen, 1994; according to Barron, 2003; Littleton & Mercer, 2010).

Taking into account these results about the importance of exchange of different ideas and its discussion for joint learning, in a previous study (Buđevac, 2011) we have analysed the conversations

of seven-year-olds while reading together. Having in mind that children of that age still find challenging to establish and regulate a joint work, the aim was to identify different conversational paths in which children manage to reach a convergence of opinions. Analysing 45 sequences⁴ in which children did not start the conversation from the same point of view (they either started from different points of view or one standpoint remained unstated), we were interested to understand how the process of negotiation unfolds, thus what children take as relevant reasons to accept or do not accept the other's point of view and how do they manage to persuade the partner to accept their ideas. We have found several ways in which the starting divergence in opinions is resolved. Apart from the others, we have found ten sequences in which the convergence of opinions was reached as the result of argumentation use. Having in mind the importance of its use for the construction of new knowledge and individual development on one side, as well as developmental characteristics of seven-year-olds on the other, it is very relevant to deepen the understanding of the way children of this age use it as a conversational tool. For that reason, this paper analyses sequences in which one or both children use argumentation while reading together. Our aim is to look at the function of the argumentation in solving tasks but also on its role in regulation of social relations among partners. Since argumentation is defined as a dialogical activity, engagement in argumentative dialogue should not only influence the acceptability of expressed standpoints, but can also have an impact on the way the joint activity is performed.

The study design

The study was conducted in two phases – individual pre-test and dyadic interaction two weeks after. In the first phase 149 children were tested by

⁴ Here, *sequence* refers to the overall dialogue concerning a single task.

reading comprehension items. All items (41 in total) were taken from the books *Language schools 1* and *Language schools 4*⁵. These books are used in some schools in Serbia as student books, but it was checked and confirmed in advance that they are not in use in two schools participating in this study. For the purpose of pre-test, tasks were grouped, so each child was tested by 10-12 items. The presentation of the tasks was balanced – each item was seen by the randomly selected children and the items were combined in groups according to their difficulty. Solving the tasks in the pre-test phase did not take more than 45 minutes.

According to pre-test results, we have selected pairs of children and tasks for the interactional phase. Children were grouped according to the following criteria: each pair consisted of children of the same gender (half of the pairs were boy-boy and half girl-girl), coming from the same class (so that they know each other), with identical score from the pre-test phase (symmetrical peer interaction). The sample for the interactional phase included 16 pairs of children. For each pair we have selected five tasks that were a bit above their performances on pre-test according to their positions at the reading competence scale (Buđevac & Baucal, 2014). Other criteria that was followed was to select tasks that were not seen by selected children in the pre-test phase.

During the interactional phase each child was firstly asked to solve selected tasks individually and immediately after to participate in a joint work on the same tasks with another child. The instruction that they received was to discuss and try to reach an agreement about the correct solution of each task. All the interactions were video recorded and transcribed⁶.

5 Jezičke školice 1, Radni listovi za srpski jezik sa zadacima različitih nivoa težine, Kreativni centar, Beograd, 2007.

Jezičke školice 4, Radni listovi za srpski jezik sa zadacima različitih nivoa težine, Kreativni centar, Beograd, 2008.

6 The system of transcription we have used is elaborated by Jefferson (2004). The description of all symbols used in this paper can be found in Appendix 1.

Corpus of data

The complete corpus of collected data consists of 90 sequences (16 pairs; 5 different tasks per pair). Continuing previous work (Buđevac, 2011) in which we have analysed only the sequences where children started the discussion from different points of view about the possible answer or one stand-point remained unstated, for this study we made a more deep analysis on the sequences in which the divergence of opinions was resolved by the use of argumentation. We have found and analysed 10 sequences with these characteristics.

Results

By analysing sequences of interaction in which a divergence of opinions was resolved as a result of the use of argumentation, there are several insights that shed the light on the way seven-year-olds produce argumentation and respond to it while working on tasks above their individual competencies. In particular, we can say that there is a pattern of argumentation use which is repeated through almost all the interactions, i.e. that some characteristics of the argumentative dialogues are salient. Firstly, there is only one sequence in which we found that the convergence of opinions was resolved after the use of counter-argument by one partner; in all the other cases, one or both partners tried to persuade the partner to accept their opinion only by elaborating why that opinion should be accepted (one-sided argumentation). Taking into consideration that the process of decentration is still not over at the age of seven (Piaget, 1995), it is expected that children face the difficulties in taking into consideration the other's point of view, which makes the use of counter-arguments difficult. Secondly, there is no co-construction of argumentation, as it is the case in interactions of older participants, but in all the cases one child formulates the argument and the other responds to it (mostly by accepting). Due to the lack of possibility to take the perspective of the part-

ner, children usually do not manage to finely adapt their interventions to their partner's ideas. The only child that managed to do that is the one producing counter-arguments during the interaction. As this sequence is specific within the corpus of analysed data – it contains several characteristics of interaction found at the older ages which are taken as relevant for the development of new knowledge through joint work (Schwarz et al., 2000) – we will present it and analyse it in details. Finally, analysing argumentative dialogues we have found that its effect in most of the cases (9 out of 10) is that the convergence of opinions was grasped. That is exactly what is expected as that is the main function of argumentation by its definition – to increase or decrease the acceptability of expressed ideas (Walton, 2006). However, in one case apart from grasping the joint solution of the task, the result of argumentation use was also the change in social positioning within the interaction

(see the excerpt 3 and its analysis). Taking the perspective that argumentation is dialogically embedded (Kuhn et al., 1997; Walton, 2006; Arcidiacono & Perret-Clermont, 2009, 2010), this example is relevant for the understanding of how it can influence the way a joint work is done.

In the following section we present the analysis of three excerpts. We will start with an excerpt that represents the most common way in which the argumentation use leads toward the acceptance of the partner's opinion in seven-year-olds dialogues. After that we will present two examples that are “not typical” – one as an example of counter-argument use and the other where we found the effect of argumentation not only in convergence of opinions, but also in social positioning. At the beginning of each excerpt, we will present the task on which children work together, the transcription of the dialogue and then the analysis.

Excerpt 1

TIMETABLE

This is the I₂ class' timetable in one primary school. Read it carefully and answer the following questions.

I₂ TIMETABLE					
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1.	Mathematics	Serbian language	Mathematics	Serbian language	Physical exercise
2.	Serbian language	The world around us	Religious education	Mathematics	English language
3.	Physical exercise	Mathematics	Physical exercise	Art	Serbian language
4.	Music	Civil education	Serbian language	The world around us	Mathematics

What is RIGHT and what is WRONG according to the timetable?

On Wednesdays the class I ₂ attends Mathematics course.	RIGHT	WRONG
On Fridays the class I ₂ has got three classes.	RIGHT	WRONG
During the second class on Mondays, the class I ₂ attends the Serbian language course.	RIGHT	WRONG
During the last class on Fridays, the class I ₂ attends the Mathematics course.	RIGHT	WRONG

Participants: experimenter (Exp); Petar (a boy, 7 years, 5 months); Ivan (a boy, 7 years, 8 months)

According to their pre-test scores children are categorised as low-level readers. During the individual work in the second phase, both children gave wrong answers on this task.

The following excerpt is a part of the final conversation around this task. Before that children worked on the task without sharing and discussing ideas about possible answer, but Ivan circled the first two answers on his own, and then Petar circled the last one again without consulting the partner. After they finished, they started the conversation with the experimenter in order to explain their answers.

81. **Petar: that is [wrong] ((refers to the second sentence in the table: "On Fridays the class I₂ has got three classes."))**
Petar: to je [netačno] ((referira na drugu rečenicu iz tabele: "Petkom I₂ ima tri časa."))
82. **Ivan: [that one]**
Ivan: [tu sad]
83. **Exp: mhm**
Exp: mhm
84. **Ivan: class two:: (.) no during the last class (.) on fridays class two attends mathematics course (.) wrong**
Ivan: prvo dva:: (.) ne petkom prvo dva ima (.) poslednji ča:s matematiku (.) netačno
85. **Exp: mhm (.) how do you [know]**
Exp: mhm (.) kako [znate]
86. **Petar: [that is] MATHEMATICS ((points at the paper)) (.) they attend (.) on fridays mathematics course is during the last class ((looks at Ivan))**
Petar: [to je] MATEMATIKA ((pokazuje prstom na papir)) (.) imaju (.) petkom je matematika poslednji ča::s ((gleda u Ivana))

87. **Ivan: ((looks at the paper)) (1.0) ((smiles)) right ((looks at the Exp))**
Ivan: ((gleda u papir)) (1.0) ((osmehne se)) tačno ((pogleda u Exp))

During the conversation with the experimenter Petar realized that previously they made a mistake. He is supporting his new answer by referring to the text – saying what is written and pointing at the proper place in the table (line 86).

Having in mind the question we have already posed in the introduction about the effectiveness of symmetrical peer interaction at the ages before the process of decentration is over, it is very important to emphasize that in this case children started from two wrong answers on the task and finished with the right one. However, it is also relevant that this insight is not the result of the joint work, sharing ideas and co-construction of arguments within interaction, as it is described in studies with older children (Schwarz et al., 2000). In this dialogue, the correct answer is the result of an individual insight during the dialogue with researcher, based on a metacognitive question *How do you know?*. On the other hand, the other child was sensitive to the argument provided by the partner and accepted the proposed answer.

Excerpt 2

This conversation is the only example of the use of two-sided argumentation that we have found in the corpus of data – one child uses an argument to support his own point of view, but also contradicts to other's opinion by the use of a counter-argument. Although this is not rare at the older ages, it seems that is still not common for seven years olds.

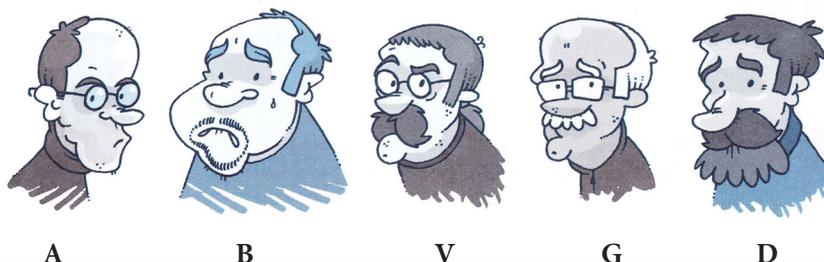
THE THIEF

Three children saw the thief who stole the book from the shop.

The first child saw that the thief has moustaches. The second child saw that the thief has glasses, and the third one saw that the thief is balding.

Find the thief among the pictures.

Circle the letter below the picture of thief.



Participants: Dule (boy, 8 years, 2 months), Marko (boy, 7 years, 11 months), experimenter (Exp).

According to pre-test results, both boys were categorized as middle level readers. During the individual work on this task, Dule solved the task and Marko did not.

Here we present the complete conversation around the task.

1. Dule: Θ (0.5) you are going to read ((looks at Marko))
Dule: Θ (0.5) a ti ćeš da čitaš ((gleda u Marka))
2. Marko: ok ((nods))
Marko: dobro ((klima glavom))
3. Dule: let's (.) read
Dule: ajde (.) da čitaš
4. Marko: three children saw the thief who s (.) s stole the book from the shop (.) the first child saw Θ (.) that the thief has moustaches (1.0) the second child saw that the thief has glasses and the third one saw that the thief (.) is b (.) al (.) ding (.) find the thief among

the pictures (.) circle the letter before the picture of thief

- Marko: troje dece je videlo lopova koji je u (.) u ukrao knjigu iz prodavnice (.) prvo dete je videlo Θ (.) da lopov ima brkove (1.0) drugo dete je videlo da lopov nosi naočare a treće dete je videlo da l je lopov (.) pb (.) brbo (.) bčelav (.) pronadi lopova na slici (.) zaokruži slovo ispred slike lopova
5. Dule: ((circles the answer g)) here it is (1.5) we have circled (.) now the next ((starts turning the next page, but Marko stops him))
Dule: ((zaokružuje odgovor pod g)) eto ga (1.5) zaokružili smo (.) sad drugo ((kreće da okrene stranu))
 6. Marko: it is (.) there are two more (.) read
Marko: to ti je (.) imaju još dva pročitaj
 7. Dule: m?
Dule: m?
 8. Marko: three children saw [the thief]

- Marko: *troje troje dece je videlo [lopova]*
9. Dule: [well yes] I know (.) I read it ((turns the page)) [I was doing it]
Dule: [da pa] znam (.) pročitao sam ((okreće stranu)) [to sam ja radio]
10. Marko: [but you have everything] you have everything (.) all of this that I told you ((turns the page back)) this you (.) look
Marko: [pa sve moraš] sve moraš (.) ovo sve što sam ti rekao ((okreće nazad stranu)) ovo si (.) gle
11. Dule: what
Dule: šta
12. Marko: and thi:s ((points at the picture a)) and this ((points at the picture v))
Marko: i o:vog ((pokazuje rukom na papir)) i ovo kako se zove ((pokazuje rukom na papir))
13. Dule: [well I know]
Dule: [pa znam]
14. Marko: [and him] (.) her and these two ((having in mind the picture Dule has already circled as well as other two which he proposed to be circled))
Marko: [i njega] (.) nju i njih dvojicu ((misli na sliku koju je Dule već zaokružio i druge dve koje, prema njegovom mišljenju, treba takođe da budu zaokružene))
15. Dule: yes (.) well ye::s
Dule: da (.) pa da::
16. Marko: well circle these ((referring to pictures a and v))
Marko: pa te zaokruži ((misli na slike a i v))
17. Dule: this one does not have the moustaches ((points at the paper)) this one has the glasses ((points at the paper)) this one is balding ((points at the paper))
Dule: ovaj nema brkove ((pokazuje na sliku)) ovaj ima naočare ((pokazuje na sliku)) ovaj je ćelav ((pokazuje na sliku))
18. Marko: ((looking what Dule is pointing at)) well he said (1.0) θ
Marko: ((gleda šta Dule pokazuje)) pa rekao je (1.0) θ
19. Dule: well this one is ((points at the paper))
Dule: pa ovaj je ((pokazuje na sliku))
20. Marko: the second child saw that the thief has glasses
Marko: drugo dete je videlo da lopov nosi naočare
21. Dule: well this one has glasses (0.5) and this one has glasses and the thir third and the second child saw that he has mous[taches]
Dule: pa ovaj nosi naočare (0.5) i ovaj nosi naočare a tr a drugo de a drugo dete je videlo da ima brk[ove]
22. Marko: [yes]
Marko: [da]
23. Dule: this with moustaches and this one without
Dule: ovaj sa brkovima a ovaj bez
24. Marko: ((turns the page; smiles))
Marko: ((okreće stranicu; osmehuje se))

Firstly, this is the only excerpt in which two-sided argumentation is used among seven-year-olds. Then, this conversation is specific because one child managed to adjust his actions to the other child's needs. As we can see in the transcript, Dule circled one picture without any discussion with the partner and wanted to move to the next task (turn 5). After the other child expressed a disagreement (turn 6) and said that apart from that one they should circle two more pictures (turns 10, 12, 14 and 16), Dule offers both argument as a support of his previous choice and counter-arguments by which he showed that the two additional pictures mentioned by Marko do not fit with the description given in the

text (turns 17, 21 and 23). Looking at each of Dule's turns, he was building an elaboration of his stand-point gradually, as he was invited by the partner to do so. This is in line with the idea that argumentation is a dialogical process of co-construction, rather than a result of the interaction itself (Kuhn et al., 1997; Arcidiacono & Perret-Clermont, 2009, 2010). However, it is expected that this kind of intervention is rare at the age of seven due to the lack of cognitive and social competencies necessary for taking into consideration the perspective of others (Piaget, 1995; Muller Mirza et al., 2009). Yet, this excerpt shows that in some occasions seven-year-olds can co-construct arguments within interaction as well as that the use of counter-argument can lead towards the change of the other's opinion.

Excerpt 3

This example is particularly relevant from the perspective of argumentation use as it shows how argumentation can lead not only toward the acceptance of some points of view, but also toward the change of the way the joint activity is performed.

In the case of this excerpt, the task children were solving together was the same as the task presented in the first excerpt.

Participants: Milan (boy, 7 years, 3 months), Jovan (boy, 7 years, 5 months), experimenter (Exp).

According to pre-test results both children were categorised as a low level readers. During the individual phase, Jovan managed to solve the task correctly, but Milan did not.

1. **Milan:** ((looks at the exp)) **I know it by heart**
Milan: ((gleda u exp)) *znam napamet*
2. **Exp:** **mhm (.) well explain to jovan agree together**
Exp: *mhm (.) pa objasni jovanu dogovorite se zajedno*
3. **Milan:** ((looks at the paper)) **[this ye:s]**

Milan: ((gleda u papir)) *[ovo pod da:]*

4. **Jovan:** **[wait wait] it is not yes**
Jovan: *[čekaj čekaj] (.) nije pod da*
5. **Milan:** **yes yes yes no (1.0) this is yes**
Milan: *da da da ne (1.0) ovo je da*
6. **Jovan:** **it is not**
Jovan: *nije*
7. **Milan:** **((circles))**
Milan: *((zaokružuje))*
8. **Jovan:** **((reads the task very quietly)) ()**
Jovan: *((veoma tiho se čuje da čita zadatak)) ()*
9. **Milan:** **let's this ((points at the next task))**
Milan: *ajd ovo ((pokazuje na sledeći zadatak))*
10. **Jovan:** **((whispers)) during the second class attends the Serbian language course ((looks at the table; points at the table)) (6.0) e: (.) but this is ri::ght (.) because you see that they attend the serbian language course ((points at the table)) during the second class**
Jovan: *((šapatom)) ima dr drugi čas srpski ((gleda u tabelu, pokazuje prstom na tabelu)) (6.0) e: (.) pa ovo je tačno:: (.) pošto vidiš da je drugi čas ((pokazuje prstom na tabelu)) srpski jezik*
11. **Milan:** **((looks at the paper; smiles)) ah ((affirmative))**
Milan: *((gleda u papir; osmehuje se)) ah ((potvrđno))*
12. **Jovan:** **this is right**
Jovan: *ovo je tačno*
13. **Milan:** **((erases the answer which he has written before))**
Milan: *((briše odgovor koji je prethodno napisao))*
14. **Jovan:** **only this wrong ((points at the paper)) that is right (.) right**

and (.) circle that (1.0) circle that

Jovan: samo ovo netačno ((pokazuje na papir)) to je tačno (.) tačno i (.) to zaokruži (1.0) to zaokruži

15. Milan: ((circles)) and this?

Milan: ((zaokružuje)) a ovo?

16. Jovan: ((looks at the table)) this (.) this i:s (1.0) this is right

Jovan: ((gleda u tabelu)) ovo (.) ovo je: (1.0) ovo je tačno

17. Milan: ((circles))

Milan: ((zaokružuje))

The dialogue starts with the expression of two different points of view – firstly Milan gives his opinion (turns 3 and 5) and then Jovan rejects it (turns 4 and 6). However, Milan decides to circle the answer in accordance with his opinion, without discussing it with the partner (turn 7). By doing it he shows that he does not intend to discuss about the answer on this task with the other child. Additionally, he expressed the intention to move to the next task (turn 9), again showing that from his perspective the solving of this task is over. However, Jovan continues to follow his own idea – he reads the table, finds the proper information and uses it as a support of his standpoint (turn 10). What is especially interesting about this excerpt is that by offering the argument in support of his standpoint, Jovan manages not only to persuade the peer to accept his claim, but also to position himself as a relevant partner in the conversation whose opinion should be taken into account. This change is visible from turns 7, 9, 15 and 17 – firstly Milan circles the answer without consulting the partner and tries to move to the next task and, after Jovan's elaboration including argumentation, he asks him for the opinion about the other answers within the same task and follows his suggestion.

Discussion and conclusions

The aim of the presented analysis was to shed the light on the way seven-year-olds produce and

understand argumentation while working together. The relevance of this topic ensues from several conclusions of previous studies. From one side, argumentative dialogues are considered as inevitable from the perspective of learning through joint problem solving (Mercer, 2000; Fernández et al., 2001; Mercer & Littleton, 2007; Schwarz & Linchevski, 2007; Schwarz et al., 2008; Howe, 2010; Littleton & Mercer, 2010). Studies revealed that argumentative dialogues offer more opportunities for learning than other types of dialogues (such as *disputational* or *cumulative* – Mercer, 2000) with more robust developmental changes (Schwarz et al., 2000; Asterhan & Schwarz, 2009). On the other side, looking at the developmental preconditions necessary to engage in argumentative discussion and sustain it (social and cognitive decentration; generalisation ability), one can question if seven-year-olds could construct argumentation when they are not supported by the context, i.e. when they cannot rely on contextual factors (such as when they participate in spontaneous, everyday conversation, cf. Muller Mirza et al., 2009). In other words, although we know that children start enrolling in argumentative discussions early in their lives, much before the age of seven (Arcidiacono & Bova, 2013; Pontecorvo & Arcidiacono, 2014), data from experimental research in the educational context show that the use of argumentation at this age still is not stable and depends on contextual factors (Muller Mirza et al., 2009).

From the analysed corpus of data we have observed that in some cases seven-year-olds use argumentation as a conversational tool when they are faced with the difference in opinions during a joint work. In addition, they appear sensitive to argumentation, thus they react on arguments offered by the partner, wherein we have observed two different effects of argumentation use: (1) the acceptance of the standpoint supported by the argument; (2) the change in the way the joint activity is unfolding (from individual to joint work). Although very rare, the second effect shows that seven-year-olds recognize argumentation as a powerful tool which they use as an indi-

cator that the partners' opinion should be taken into account and as an incentive for rethinking the task solution. Also, it reveals that, in their view, there is a potential benefit of collaboration comparing to individual work. Another indicator of the way seven-year-olds understand the role of argumentation is the fact that argumentation always appears as a result of expressed difference in opinions. In our sample, there are no examples in which a child claims something and immediately offers an argument to support the claim. Although from the perspective of pragma-dialectical theory approach to argumentation (Zarefsky, 1995; van Eemeren et al., 1996) argumentation appears as a result of the need to justify a standpoint, which actually happens when we are faced with a difference of opinions, it is not the only reason to use argumentation. Analysing the interaction among older children (ten-year-olds) we have found examples in which they express the claim together with an argument that supports it, even before partner expresses doubt or contradicts to it (Buđevac, 2013). Therefore, this regularity found in the corpus of data of seven-year-olds interaction can be taken as an indicator of the difficulty to anticipate that the other child can have a different point of view (Piaget, 1995). In continuity with this, we have not found examples in which both children express standpoints and arguments in support to it. We have found always the same pattern, namely that when one child provides an argument for the standpoint it is accepted by the other (even if it is not always correct). The fact that in all cases we presented the "joint work" starts by circling the answer that a child finds appropriate, without discussing it with the partner, can be taken as an additional sign of the difficulty to take the position of the other (Piaget, 1995). This is related to another finding regarding argumentation use – seven-year-olds usually do not manage to offer two-sided argumentation while talking about the task solutions. We have found only one example in which a child showed the ability to decenter and to present to a partner why the proposed answer was not correct and at the same time why the one he proposed should be accepted.

Although our findings show that developmental preconditions necessary for engagement in argumentative dialogues are not completely fulfilled at the age of seven, it is very important to organize joint work through peer interaction also with children of that age. Even if learning process through this kind of activity could be to some extent interrupted or delayed, we can say that it opens the possibility for children to gain experience necessary for the joint work. This kind of practice should be taken as an important preparatory step for the future learning through peer interaction. In addition, to some extent it also provides opportunities for children to build a new understanding of the task solution. Also, as they are still facing difficulties in coordinating different perspectives, offering argumentation pro and contra some standpoints and collaborating with a peer it is important to provide some scaffolding (Wood et al., 1976) in order to sustain their joint work and increase the developmental potential of this kind of activity. This scaffolding can be provided directly by the teacher who could intervene in situations when he/she perceives that children cannot take into account some important aspects of a task or others' points of view. In addition, as building a collaboration and sharing thoughts with a partner before the decision about the proper answer appear as particularly demanding at this age, teachers should provide some additional guiding about the "rules" of the joint work and try to secure its unfolding. In other words, we suggest that joint work at this age, although it does not fully support learning of the content aimed by the tasks, offers other educationally relevant benefits. Namely, it creates the space for the children to gradually appropriate skills necessary for the collaborative work which are still not fully developed at the age of seven (such as coordinating one's own activity with the partner's, taking into account other's point of view, negotiating about possible solutions of the task), thus it can serve as some kind of a scaffolding during the preparatory steps for the future learning through peer interaction.

References

- Ames, G. J. & Murray, F. B. (1982). When Two Wrongs Make a Right: Promoting Cognitive Change by Social Conflict. *Developmental Psychology*, 18(6), 894–897.
- Arcidiacono, F. & Perret-Clermont, A.-N. (2009). Revisiting the Piagetian test of conservation of quantities of liquid: Argumentation within the adult-child interaction. *Cultural-Historical Psychology*, 3, 25–33.
- Arcidiacono, F., & Perret-Clermont, A.-N. (2010). The co-construction of conversational moves in the context of Piagetian interview: The case of the test of conservation of quantities of liquid. *Rassegna di Psicologia*, 27(2), 117–137.
- Arcidiacono, F., & Bova, A. (2013). Argumentation among family members in Italy and Switzerland: A cross-cultural perspective. In Y. Kashima, E. S. Kashima, R. Beatson (Eds.), *Steering the Cultural Dynamics* (pp. 167–174). Melbourne: IACCP.
- Asterhan, C. S. C., & Schwarz, B. B. (2009). Argumentation and Explanation in Conceptual Change: Indications From Protocol Analyses of Peer-to-Peer Dialog. *Cognitive Science*, 33, 374–400.
- Baker, M. J. (2002). Argumentative interactions, discursive operations and learning to model in science. In P. Brna, M. Baker, K. Stenning & A. Tiberghien (Eds.), *The role of communication in learning to model* (pp. 303–324). Mahwah, NJ: Lawrence Erlbaum Associates.
- Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *The Journal of the Learning Sciences*, 9, 403–436.
- Barron, B. (2003). When Smart Groups Fail. *The Journal of the Learning Sciences*, 12(3), 307–359.
- Buđevac, N. (2011). “I’ll accept, but next time you’ll have to listen to me!” How seven-year-olds read together. In A. Baucal, F. Arcidiacono & N. Buđevac (Eds.), *Studying interaction in different contexts: A qualitative view* (pp. 91–122). Belgrade: Institute of Psychology.
- Buđevac, N. (2013). *Razvojni efekat simetrične vršnjačke interakcije tokom početnog ovladavanja čitalačkom pismoću* [Developmental effect of symmetrical peer interaction during initial phases of reading literacy development], Neobjavljena doktorska disertacija, Filozofski fakultet, Univerzitet u Beogradu.
- Buđevac, N., & Baucal, A. (2014). Razvoj čitalačke pismenosti tokom prva četiri razreda osnovne škole [Development of reading literacy during the first four grades of elementary school], *Inovacije u nastavi*, 27(2), 22–32.
- Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, 64(1), 1–35.
- Doise, W., & Mugny, G. (1979). Individual and collective conflicts of centration in cognitive development. *European Journal of Social Psychology*, 9, 245–247.
- Doise, W., Mugny, G., & Perret-Clermont, A.-N. (1975). Social interaction and the development of logical operations. *European Journal of Social Psychology*, 6, 367–383.
- Fernández, M., Wegerif, R., Mercer, N., & Rojas-Drummond, S. M. (2001). Re-conceptualizing „Scaffolding“ and the Zone of proximal development in the Context of Symetrical Collaborative Learning. *Journal of Classroom Interaction*, 36(2), 40–54.
- Grossen, M. (1994). Theoretical and methodological consequences of a change in the unit of analysis for the study of peer interactions in a problem solving situation. *European Journal of Education*, 9(1), 159–173.

- Hogan, K., Nastasi, B. K., & Pressley, M. (2000). Discourse patterns and collaborative scientific reasoning in peer and teacher-guided discussions. *Cognition and Instruction*, 17, 379–432.
- Howe, C. (2010). Peer dialogue and cognitive development. In L. Littleton & C. Howe (Eds.), *Educational Dialogues: Understanding and promoting productive interaction* (pp. 32–47). London: Routledge.
- Howe, C., Tolmie A., Thurston, A., Topping, K., Christie, D., Livingston, K., Jessiman, E., & Donaldson, C. (2007). Group work in elementary science: Towards organizational principles for supporting pupil learning. *Learning and Instruction*, 17, 549–563.
- Jefferson, G. (2004). Glossary of transcript symbols with an introduction. In G. H. Lerner (Ed.), *Conversation Analysis: Studies from the first generation* (pp. 13–31). Philadelphia, PA: Benjamins.
- Krstić, K., & Baucal, A. (2003). Symmetrical social relation as a factor in Conservation task. *Psihologija*, 36(4), 471–485.
- Kuhn, D., Shaw, V., & Felton, M. (1997). Effects of Dyadic Interaction on Argumentative Reasoning. *Cognition & Instruction*, 15(3), 287–315.
- Light, P., & Littleton, K. (2004). *Social processes in Children's Learning*. Cambridge: Cambridge University Press.
- Light, P., & Perret-Clermont, A.-N. (1989). Social context effects in learning and testing. In A. Gellatly, D. Rogers & J. A. Sloboda (Eds.), *Cognition and Social Worlds* (pp. 99–112). Oxford: Oxford University Press.
- Limon, M. (2001). On the cognitive conflict as an instructional strategy for conceptual change: a critical appraisal. *Learning and Instruction*, 11, 357–380.
- Littleton, K., & Mercer, N. (2010). The significance of educational dialogues between primary school children. In L. Littleton & C. Howe (Eds.), *Educational Dialogues: Understanding and promoting productive interaction* (pp. 271–288). London: Routledge.
- Mercer, N. (2000). *Words and Minds: How We Use Language to Think Together*. London: Routledge.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the Development of Children's thinking: A sociocultural approach*. London: Routledge.
- Mugny, G., & Doise, W. (1978). Socio-cognitive conflict and structure of individual and collective performances. *European Journal of Social Psychology*, 8, 181–192.
- Muller Mirza, N., Perret-Clermont, A.-N., Tartas, V., & Iannaccone A. (2009). Psychosocial Processes in Argumentation. In N. Muller Mirza & A.-N. Perret-Clermont (Eds.), *Argumentation and Education. Theoretical Foundations and Practices* (pp. 67–90). New York, NY: Springer.
- Piaget, J. (1995). *Sociological studies*. London: Routledge.
- Pontecorvo, C., & Arcidiacono, F. (2014). Social interactions in families and schools as contexts for the development of spaces of thinking. In T. Zittoun & A. Iannaccone (Eds.), *Activity of thinking in social spaces* (pp. 83–97). New York, NY: Nova Science Publishers.
- Salomon, G., & Globerson, T. (1989). When teams do not function the way they ought to. *International Journal of Educational Research*, 13, 89–99.
- Schwarz, B. B. (1995). The emergence of abstract representations in dyad problem solving. *Journal of the Learning Sciences*, 4, 321–354.

- Schwarz, B. B., & Linchevski, L. (2007). The role of task design and argumentation in cognitive development during peer interaction: The case of proportional reasoning. *Learning and Instruction, 17*, 510–531.
- Schwarz, B. B., Neuman, Y., & Biezuner, S. (2000). Two wrongs make a right...if they argue together! *Cognition & Instruction, 18*, 461–494.
- Schwarz, B. B., Perret-Clermont A.-N., Trogon A., & Marro, P. (2008). Emergent learning in Successive activities: Learning in interaction in a laboratory context. *Pragmatics and Cognition, 16*(1), 57–87.
- Siegal, M. (1991). *Knowing children: Experiments in Conservation and Cognition*. Hove: Lawrence Erlbaum Associates.
- Sorsana, C. (2008). Peer's verbal interactions specificity on cognitive development. *European Journal of Developmental Psychology, 5*(5), 544–560.
- Tartas, V., & Perret-Clermont, A.-N. (2008). Socio-cognitive dynamics in dyadic interaction: How do you work together to solve Kohs cubes? *European Journal of Developmental Psychology, 5*(5), 561–584.
- Tudge, R. H. J. (1992). Processes and Consequences of Peer Collaboration: A Vygotskian Analysis. *Child Development, 63*, 1364–1379.
- Tudge, J. R. H., Winterhoff, P. A., & Hogan, D. M. (1996). The consequences of collaborative problem solving with and without feed-back. *Child Development, 67*, 2892–2909.
- Walton, D. (2006). *Fundamentals of critical argumentation: Critical reasoning and argumentation*. New York, NY: Cambridge University Press.
- Webb, N., Zuniga, S., & Welner, K. M. (2001, April). *Effects of group composition on high-ability student's achievement in science*. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.
- Wood, D., Bruner J., & Ross, G. (1976). The role of tutoring in problem-solving, *Journal of Child Psychology and Child Psychiatry, 17*, 89–100.
- van Eemeren, F. H., Grootendorst, R., Henkenmans, F. S., Blair, J. A., Johnson, R. H., Krabb, E. C. W., Plantin, C., Walton, D. N., Willard, C. A., Woods, J., & Zarefsky, D. (1996). *Fundamentals of argumentation theory: A handbook of historical background and contemporary developments*, Mahwah, NJ: Lawrence Erlbaum Associates.
- Vygotsky, L. S. (1962). *Thought and Language*. Cambridge, MA: MIT Press.
- Vygotsky, L. S. (1978). *Mind in Society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Zarefsky, D. (1995). Argumentation in the tradition of speech communication studies. In F. H. van Eemeren, R. Grootendorst, J. A. Blair & C. A. Willard (Eds.), *Perspectives and approaches: Proceedings of the third International Conference on Argumentation* (Vol. 1, pp. 32–52). Amsterdam: Sic Sat.

Appendix 1: Transcription symbols

[the point of overlap onset

] the point at which two overlapping utterances end

= there is no break or gap between the end of a prior and the start of a next piece of talk

(0.0) pause length (in seconds)

(.) very short pause (1/10 seconds)

: prolonging of sound

__ stressed syllable, part of the work or the whole word

() non-transcribing segment of talk

(()) comments added by the transcriber in order to clarify some elements of the situation

⊖ hesitation of the speaker

XXX the part of the talk that refers to children's reading of the task (in English translation)

XXX parts of the talk said by the high tone

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Улога аргументације у разумевању прочитаног текста кроз заједнички рад седмогодишњака

Према одређењу од којег у овом раду полазимо, аргументација је дијалoшка активност током које партнери настоје да увећају или умање прихватљивост изнетих становишта. Она подразумева да учесници у интеракцији, кроз процес преговарања, успостављају специфичне везе између изнетих идеја и различитих извора знања, тежећи тако да убеду саговорника у то да одређено становиште прихвате или одбаце. Резултати низа истраживања која су се бавила учењем и развојем кроз вршњачку интеракцију показали су да је један од главних фактора од којег зависи да ли ће кроз заједнички рад доћи до развоја нових знања и/или компетенција управо то да ли ће се учесници упустити у аргументативни дијалог или не. Није, дакле, довољно да се током заједничке активности изнесу различита мишљења, већ је неопходно да се о њима дискутује и да се на основу ваљане аргументације донесе закључак о томе да ли неко од изнетих становишта треба прихватити или не. Истраживања су, такође, показала да постоје бројни фактори од којих зависи да ли ће се аргументација појавити у исказима саговорника или ће одлука бити донета на неки други начин (на пример, јер је једно дете доминантно). При томе, имајући у виду развојне предуслове који морају бити испуњени како би дете могло адекватно да

учествује у аргументативном дијалогу (способност когнитивне и социјалне децентрације, способност генерализације), налази истраживања показују да је аргументативно мишљење на узрасту од пет до седам година нестабилно и да зависи од низа контекстуалних фактора. Имајући у виду значај аргументације за учење и развој кроз вршњачку интеракцију, ови резултати отварају питање делотворности симетричне интеракције на ранијим узрастима (пре него што је процес децентрације завршен). Надовезујући се на претходно истраживање, кроз које смо видели да се аргументација спонтано појављује у дијалозима седмогодишњака док решавају задатке који испитују разумевање прочитаног текста, у овом истраживању нам је циљ да детаљно анализирамо аргументацију из тих дијалога, како бисмо разумели на који начин седмогодишњаци користе и разумеју аргументацију. Полазећи од ширег корпуса података (четрдесет пет секвенци дијалога), у анализу је ушло десет секвенци у којима је разлика у почетним становиштима разрешена навођењем аргумената од стране једног или оба детета.

Резултати су показали да на овом узрасту аргументација може имати два различита ефекта: (1) прихватање становишта које је аргументом поткрепљено; (2) промена у начину на који се заједничка активност одвија (од индивидуалног рада ка сарадњи). Иако веома редак, други ефекат указује да седмогодишњаци препознају аргументацију као показатељ да мишљење партнера треба узети у обзир приликом доношења одлуке. У складу са тим је други податак до којег смо дошли – аргументација се у анализираним дијалозима увек појављује након суочавања са различитим мишљењем. Нема, дакле, примера у којима дете износи мишљење и одмах га поткрепљује аргументима, што је случај у дијалозима старије деце. Овај резултат је у сагласности са сазнањима да деца овог узраста имају тешкоћу да антиципирају то да друго дете може имати различито мишљење од њиховог. С тим у вези, анализа је показала да седмогодишњаци готово уопште не износе контрааргументе за партнерово становиште, већ скоро искључиво аргументе којим поткрепљују своје становиште (једностран аргументација).

Иако налази указују на то да учење кроз вршњачку интеракцију на овом узрасту још увек није сасвим делотворно услед неиспуњености потребних (социјалних и когнитивних) развојних предуслова код седмогодишњака, из њих такође следи да је и на овом узрасту важно организовати учење кроз заједнички рад. Другим речима, иако овај облик рада не подржава у потпуности учење садржаја на које се задаци односе, њихово заједничко решавање може имати друге ефекте који су значајни из перспективе учења и развоја. Конкретно, учење кроз вршњачку интеракцију омогућава деци да постепено овладавају вештинама које су неопходне за учење кроз заједничку активност, а још увек нису у потпуности развијене (попут координисања сопствене активности са активношћу вршњака, сагледавања туђег гледишта, вештина преговарања).

Кључне речи: аргументација, симетрична вршњачка интеракција, учење кроз интеракцију, читање.



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A narrative format design to improve language acquisition through social interaction

Abstract: *In this paper we present a research design devoted to create opportunities of learning and development through social interaction. The study is part of a EU project called SOFT (School and family together for the immigrant children integration) that aims to favor linguistic and social integration of children through language learning activities that connect families and schools.*

Cultural and linguistic diversities are considered as elements promoting learning and cooperation among different social actors: children, teachers, parents, researchers and schools. In the present paper, we will discuss two aspects: 1) how the pedagogical design named « Narrative format » can establish a peculiar social interaction in the classroom and how, in a developmental perspective, it offers a real opportunity of cognitive and social skills improvement; 2) how social interactions between school and families help teachers, pupils and parents to develop an awareness of their roles and a strengthen their collaboration.

We have involved 15 teachers and 169 children (aged 3-7 years old) of three classes of primary schools and two kindergarten classes in Switzerland, proposing a design that provides pedagogical materials and activities devoted to teach/learn English and German language. The main questions of our study are the following: How teachers implement the pedagogical design in order to involve children in activities based on an unknown language? How does the narrative format help children learn to speak the new language and to enable the integration between teachers, children and parents? The results of our study show that the design we have implemented can create conditions that facilitate and imitate the natural (informal, discursive) acquisition of languages.

Key words: *narrative format, multilingualism, social inclusion, school-family interactions*

Introduction

This paper aims to illustrate how a research design devoted to create opportunities of learning

and development through social interaction has been implemented within an educational context. The study we will present is part of a EU project that has been conducted in order to favor the linguistic and social inclusion of children through language

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learning activities that connect families and schools. Our interest in these activities that are usually accomplished through social interactions relies on the idea that cultural and linguistic diversities are useful elements to promote learning and cooperation among different social actors in schools: children, teachers, parents, and researchers.

In the present paper, we will focus on two aspects of our research design: 1) how the pedagogical design named «narrative format» can establish a peculiar social interaction in the classroom and how, in a developmental perspective, it offers a real opportunity of cognitive and social skills improvement; and 2) how social interactions bridging school and families help teachers, pupils and parents to develop an awareness of their roles in processes of socialization and strengthen their collaboration towards social inclusion. Through the presentation and the discussion of the educational setting we have implemented, we intend to answer the following research questions: How teachers implement the pedagogical design in order to involve children in activities based on an unknown language? How does the narrative format help children learning to speak a new language and enables the integration between teachers, pupils and parents?

In the first part of the paper we will briefly present the framework within which our project has been conceived and developed. Afterwards, the main elements of our research will be described, with a specific focus on the different steps that the design implied within the educational settings of our study. Finally, some elements of reflection emerging from the results will be offered in the last section of the paper, in order to highlight to what extent the design we have implemented can create conditions that facilitate the natural acquisition of language.

A theoretical framework for the narrative format design

Our focus on the linguistic integration of children through social interactions, based on the language acquisition through activities that connect families and schools, is related to the political and societal context in which our project has been developed. In fact, in Switzerland the relevance of social inclusion issues remains current and very important, because the Swiss context is progressively confronted with an increasing heterogeneity in terms of cultures and languages spoken in schools. We consider language as a mean of social inclusion in this complex situation within primary contexts of education (such as schools and families), and as a possible way towards the establishment of effective and inclusive social practices. In order to define a synthetic framework, but broad enough to understand the nature of the project that is presented, we will refer to some key concepts that constitute useful frames to define the context of our research and its assumptions.

The first element we intend to present is connected to the integrative aim of different educational activities in schools that are more and more confronted to new societal forms shaped by movements of immigration. In our view, the social inclusion can be achieved through the creation of situations of *social interactions* throughout daily life. Different forms of interaction are at the core of the process by which people can regulate activities in formal and informal contexts: more specifically, throughout language and dialogue, the ability to interact can become a product of this discursive process of co-construction and integration. This approach is inspired by the work of Piaget (1926) and Vygotskij (1934), and is useful in the perspective of understanding the dimensions of thought's processes, and to study the conditions that allow interactions to promote apprenticeships. Social interactions are not considered as external elements or as composite variables that affect cognitive development and learning: rather, they are a set of indi-

vidual and collective dimensions related to language, communication, people's intentions, goals, social representations and results of the dynamics in which adults and children interact.

A second element of our presentation concerns the idea that learning is always *learning in context*, based on the modalities through which cognition and acquisition of knowledge are formed within social interactions. The sociocultural perspective (Wertsch, 1985; Rogoff, 1990; Valsiner, 1995; Pontecorvo & Arcidiacono, 2010, 2014) is very useful in this endeavour, because the primary contexts of interaction (e.g., families and schools) are considered to be the proper frameworks to offer opportunities to children (and adults) to enhance learning, critical attitudes and socialization processes (Resnick, Pontecorvo & Säljö, 1997; Arcidiacono, 2013). Language thus becomes a procedure of thought used in different activities and in multiple contexts: more particularly, language socialization (Ochs & Schieffelin, 1984; Schieffelin & Ochs, 1986) is assumed as a process that never ends (Ochs, 1990), because each interaction is, in a potential way, an experience of socialization, of becoming member of a community, and an opportunity of creation and sharing of meanings (Bruner, 1983).

The third element refers to the notion of *intersubjectivity* that has been adopted in several approaches and that can be referred to a variety of objects of study. In our case, intersubjectivity concerns a co-construction of shared meanings (Bruner, 1998) done by the participants during different social activities. The possibility that intersubjectivity between people occurs is related to the possibility to create a shared space, to assume the overcoming from the own private world to the assumptions of the other's universe. This way of creating relationships between people could promote social inclusion and the establishment of socialization processes in educational contexts. In particular, the activity of teaching and learning in classroom can be considered in terms of «*events because of their inter-*

actional nature and their sequential organization, in which talking shifts from party to party as the event unfolds and as a hierarchic structure marked by recurrent behavioural configurations» (Arcidiacono & Gastaldi, 2011, p. 2).

The above-mentioned approach and the key-elements included in the first part of this paper constitute the framework within which the project we have implemented is based. In our idea, it is relevant to highlight that our interest is not exclusively based on the level of linguistic integration of native and immigrant children through the learning of a new language (including the language of the host country). On the contrary, we assume that learning languages, including those spoken by migrant children at home, and sharing experiences at school and family are both relevant elements. They have to be taken into account in the implementation of an educational research design devoted to the promotion of integrative practices in different settings. For this reason, we will introduce and present the project we have conducted to favor the linguistic and social inclusion of children through language learning activities that specifically connect families and schools.

SOFT: A project connecting schools and families

The project "School and family together for the integration of immigrant children", called SOFT², has been conceived by an interdisciplinary research team, starting from a common interest in language teaching/learning in multicultural contexts. Among the questions raised by the project and on which we will return later on (with details on its implementation in Western Switzerland), a key point that we will discuss in this paper is the central question of

2 Project n° 531208-LLP-2012-IT-KA2-KA2MP – grant agreement: 4479-2012, Executive Agency of the European Commission for Education, Audiovisual and Culture, «European Union Lifelong Learning» program. We are grateful to the European Commission for the financial support and to the participant schools and families for their engagement. The present paper and its content remain under the responsibility of the authors.

the specific connection between schools and families. This aspect is particularly relevant in terms of social interaction practices that can sustain the processes of learning and teaching, because it involves all the actors participating in the primary contexts of education, such as families and schools.

The research project includes different entities coming from five different European countries (Italy, Germany, UK, Spain and Switzerland)³ working together in order to develop pedagogical activities related to a double perspective: firstly, the fact that a constructive relationship between school and family potentially produces benefits for both adults and children; secondly, that previous research experiences (e.g., the projects Socrates Lingua “The Adventures of Hocus and Lotus”, 1997-2000; “The Di-

3 The first partner is the University of Rome “Sapienza” (Italy), leading the network of participants and conducting the research at pre-school and primary level. The activities are performed in collaboration with the research team of the University of Rome 3 (Italy), that is in charge to investigate the influence of prejudices and stereotypes in the integration process of children from immigrant backgrounds and to analyze the relations between schools and families. A third partner is the Dinocroc International Training Institute in Rome (Italy) that deals with the production and publication of the necessary pedagogical equipment used in the project, as well as the organization of training courses about the narrative format for teachers of different degrees. The Kommunalen Integrationszentren in Essen (Germany) is the partner in charge to create designs and opportunities of collaboration for native and migrant children and their families. They provide training and mentoring activities as part of a working network including children, adolescents, families, teachers, speech therapists and political authorities. In Spain, the monitoring of the project is guaranteed by the Escuela de Negocios y Administracion de Empresas in Barcelona, a training institution specialized in language issues, administrative management and new technologies. From a scientific point of view, the project relies on the contributions of the research team based at the University of Edinburgh (Scotland), with a specific focus on the development of bilingualism and, in the Swiss context, on the activities guaranteed by the University of Teacher Education BEJUNE in Biel/Bienne. Our research team acts as Swiss partner within the project, ensuring the development and the promotion of research around the topics of cultural and linguistic heterogeneity, social representations and practices of teaching/learning processes in kindergarten and primary schools.

nocrocs grow up”, 2001-2004; “Let’s become a bilingual family”, 2010-2012) have empirically shown the benefits of learning a new language through specific educational programs. For this reason, the project we are presenting here uses a pedagogical program inspired by the narrative model format (for further details, cf. the project website: www.softintegration.eu) in order to promote the social inclusion of immigrant and native children in different countries. Training proposed to the participant teachers and a series of activities connecting families and schools are relevant part of the pedagogical design of the SOFT project, and will be presented in the following part of this paper.

Multilingualism: The narrative format as a pedagogical tool based on social interactions

Switzerland is a multilingual country. Four national languages co-exist and determine a particular context characterized by heterogeneity, diversity and multiple linguistic and cultural resources. Owning two or more languages is then usual and important not only because it gives to children the opportunity to understand cultures or sub-cultures within the same country, but also because bilingualism and multilingualism bring cognitive advantages, early acquisition of words, structures and sounds of languages. In fact, children that are immersed in bilingual or multilingual contexts often learn to read before others and they usually find easier to learn additional languages (Bialystok, 1986). Bilingual children are also able to be more attentive, less distracted by irrelevant information, and they can more easily move from one task to another. Many of these benefits were found in adults who have grown up as bilingual. Indeed, the effects of bilingualism and multilingualism have a significant impact on the mental capacities of individuals from childhood until adulthood (Sorace, 2007), for example in terms of mental flexibility (Ghimenton, 2014). The aim of this paper is not to discuss the notions of bilingualism and multilingualism (the reader can refer to a

large literature on the topic: for a synthetic review, cf. Arcidiacono, 2014; for other sources, cf. Weinreich, 1968; Mackey, 2000; Grosjean, 2013). The objective is to present a pedagogical tool (namely, the narrative format) that has been conceived and used as a model of teaching/learning languages with children. Some elements of the implementation of this model in the Swiss context will also follow in the next sections of the paper.

The narrative format is a psycholinguistic model of language education for children in kindergarten, primary school and nursery. The label has been created by Taeschner (2005), clearly inspired by the fundamental work of Bruner on the notion of format (Bruner, 1998): “The acquisition of language begins before the child issued its first lexical-grammatical speech. It begins when the mother and the child create a predictable interaction format that can serve as a microcosm for communication and the creation of a shared reality. Transactions that occur in such formats are the ‘input’ from which the child can master the grammar, how to refer and mean, and how to achieve his intentions by communicating” (pp. 128-129, our translation). These notions of “predictable interaction” and creation of a shared reality constitute the core of our interest.

The model of teaching/learning languages through the narrative format was developed through the careful study of the natural process of acquiring two languages at home. It includes a series of educational strategies, activities and materials that create the appropriate conditions for learning a new language (Taeschner, 2002, 2003; Taeschner et al., 2008; Pirchio et al., 2014). Indeed, teaching a language is not easy, especially if one does not apply an effective method. Many families whose parents speak different languages are in trouble, despite the fact that they have a perfect knowledge of the language to be taught. Facilitating the learning of two (or more) languages is a constant of the narrative format, such as to establish effective and positive communication in relation to each other (peer,

adult, caregiver). In this sense, the format is not only a tool to teach/learn languages, but it is a way to facilitate good emotional relationships and communicative acts among participants during social interactions within and outside the classroom.

The narrative format model has so far been successfully tested in more than 120 schools and is currently used by more than 4000 teachers across Europe. Four fundamental concepts are sustaining the narrative format approach:

- the principle of the narrative form of the thought that assumes that learning a foreign language is possible in a way that is analogous to the process of the first language acquisition. This implies the value of repetitive experiences, shared by the child with others (specifically, the adults), the use of storytelling, with the support of gestures and mimic allowing the meaning of words and phrases to be learnt through active work;
- the principle of good communication implying that an emotional bond among the conversational partners is essential to learn to speak. Establishing a relationship of affection and complicity is a key to motivate interlocutors and to improve their desire to communicate;
- the principle of using a language per situation (bilingualism) assumes that choosing and keeping a common language of conversation (e.g. English for French speaking people) is the condition for avoiding communication in the everyday local language and for sharing the chosen foreign language during joint activities;
- the principle of linguistic progression refers to the fact that the development of the vocabulary and language acquisition increases through a variety of experiences that are elaborated within different narrative formats.

A specific design to use the narrative format

In order to use the narrative format (and its principles) in the classroom, we have developed a design consisting of a set of pedagogical material combined with different activities including children and adults.

In our research, we have involved 15 teachers and 169 children (aged three to seven years) of three classes of primary schools and two kindergarten classes in the Western part of Switzerland (French speaking cantons), proposing activities devoted to teach/learn English and German languages. Three main steps have been devoted to the implementation of the design: a first one dedicated to a specific teachers' training; a second step developing educational activities in the classroom; and a third one including joined activities with the families. We will present the pedagogical material conceived and these steps in the following part of the paper.

The pedagogical material

Our design is conceived around the adventures of Hocus and Lotus, two invented characters who teach languages to the participant children. Hocus and Lotus (see figure 1 below) have been created within the project in order to apply the narrative format in the context of children's activities at school and at home.

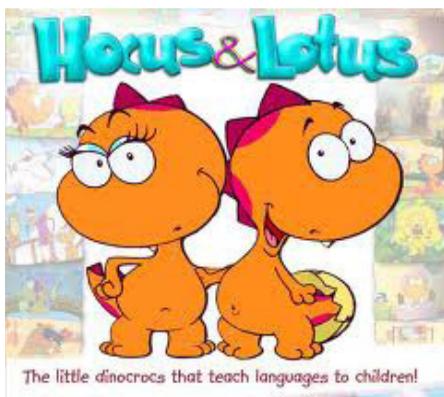


Fig. 1: Hocus and Lotus

The two protagonists of the stories are not people, but animals rather extravagant, designed with physical characteristics with which children can easily identify to. The pedagogical design is based on movies concerning the adventures of Hocus and Lotus. These stories were written according to the demands of the teachers who previously experienced them in their classes. The adventures refer to the typical children's lives, everyday contexts and situations of real experiences, such as the identification of friends to play with, situations of sharing toys, discovering places, organizing new activities, and so on. The stories are organized in different episodes representing various adventures of Hocus and Lotus. Music and songs complete dialogues during the story-telling or movies. The texts of dialogues and monologues have been specifically developed to promote the process of language acquisition through repetition and to easily identify the relationship between images and spoken words.

According to the school grade levels foreseen in the project, a different set of educational materials has been made available to participants (teachers, children and families). The set of pedagogical tools (cf. figure 2) consist of a series of DVD including six episodes of "The Adventures of Hocus and Lotus" (the length of each episode is about 5 minutes) and six booklets with pictures and texts, according to the story of each episode. Books were offered to teachers, children and families and are written in five different languages (English, German, French, Italian and Spanish). Each participant received a CD with the songs of the different episodes, a small book with the texts of each song, a t-shirt and a bag with the characters of the story. Moreover, a guide presenting the goals of the project, the main principles of the narrative format, as well as examples of activities to be performed at school and at home have been offered to each participant. Guides were available in fifteen different languages (according to the nationalities of participant children) in order to be readable for immigrant parents. In addition, each teacher received a DVD and a book for his/her training



in narrative format. Teachers, in collaboration with the research team, settled the use of the pedagogical material in classrooms. Then, children were free to use the same material at home, involving parents and siblings during their time outside school. The different episodes, music and stories were conceived in order to promote the acquisition of the selected language through the verbal repetition and the visualization of the stories, and to stimulate the use of the material inside and outside the classroom.

The Hocus and Lotus SING ALONGS

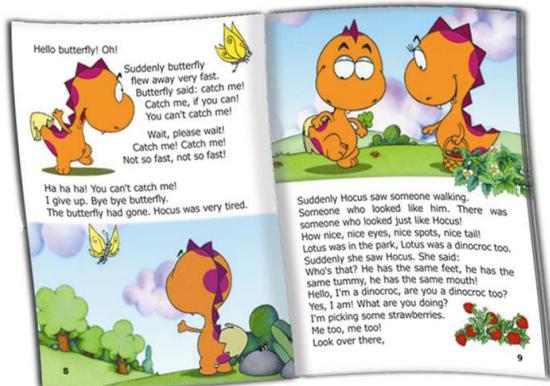


Fig. 2: The set of pedagogical material, DVD, CD and books.

Step 1. Teachers' training

Various sessions of training divided within thematic modules were organised with the participant teachers in order to introduce the main principles of the narrative format. Some of the topics of the training included items concerning interculturality, plurilingualism and school-families relations. Furthermore, specific DVDs devoted to the training, for different school degrees, were offered to the teachers in order to allow them to train themselves at home. The DVD explained and illustrated each narrative formats, through videos in which actors were playing each format (see Figure 3). Further explanations were given to teachers by the trainers (members of the research team) in order to highlight the importance of gestures and mimics which can differ from one language to another.



Fig. 3: DVD content with training activities for teachers

Step 2. The Narrative format with children in the classroom and at home

After the training, teachers were ready to perform the narrative format with their pupils. As accounted through semi-directive interviews, teachers were very interested in trying this format in their classrooms, wondering if children would “play the game” and questioning themselves on whether the project would “enter” in home activities. Observations in the classrooms and post-activity interviews showed that pupils and teachers very well performed the “practical” part of the project. As the main idea of learning languages is based on the creation and reproduction of practices of good communication based on intersubjectivity and motivation to speak with others, the interactions of the narrative format take place through the establishment of spaces of communication where “routines” (intended as shared experiences) are performed. This type of activities allows each participant to play different roles of the various characters of the story, notably through the listening and acting out activities presented by the pedagogical material. The language of the stories is grounded in simple grammar and presents themes that are familiar to the children, mostly based on contexts of their everyday lives. During the narrative format, children learn the stories by repeating it with the teachers, by acting out the episodes and singing. This way to learn words, gestures and mimics through simple formats of 5 minutes each has been elaborated according to the following six steps: 1. The opening format, a way to move from the real world of the mother tongue to the imaginary world of the adventures of Hocus and Lotus using a new language; 2. The acting out of the story, a performance of the episode orally told by the teacher, and integrated by gestures and mimics; 3. The musical, the moment in which children are singing the story, repeating the vocabulary and the expressions used in the acting out; 4. The reading activity performed using the books that illustrate the stories; 5. The cartoon, watched together in order to recall the

story; 6. The return to the real life, a final step that indicates to children that they are back from the imaginary world of the new language to the real world of the mother tongue.

According to our pedagogical design, children are requested to take the material at home and to freely repeat the formats alone or with other members of their family (e.g., singing or listening the music, watching the DVDs with parents or siblings, reading the book, etc.). The audio data collected during interviews with parents showed that they were really engaged in using the pedagogical material at home.

Step 3. Teachers-parents shared activities

A further level of our pedagogical design concerns the joint activities between families and schools that were organized by inviting parents and siblings at school. These meetings were organised twice in the school-year, and quite all invited parents were present. During these occasions, parents, children and teachers were working together around different subjects, such as intercultural education, mutual knowledge, and multilingualism as a resource for the society. According to the heterogeneous composition of the participant classroom and families, these activities have constituted invaluable opportunities to share different cultural and linguistic realities among adults and children. The engagement of all the actors involved in the project has made possible the organization of different activities at school (e.g., such as shows, games, picnics, activities of painting, etc.). These moments also were a space of sharing intercultural experiences based on opinions and testimonies on the project lines and on teaching/learning languages. Some parents were happy to use these moments as opportunities to share their own story of learner or agent of language transmission at home.

The implementation of the pedagogical design

As said above, we have involved 15 teachers and 169 children (aged three to seven years) of three classes of primary schools and two kindergarten classes in the Western part of Switzerland (French speaking cantons). We have collected qualitative data, mainly through interviews (audio-recorded in step 1 and step 2) and observations (ethnographic notes and videos in step 2 and 3). Unlike other countries involved in the SOFT project, Switzerland has by its multilingual policy structure and migration flows a long reflection on language issues (foreign languages, L2), and not only on national languages (L1). Notably, the political decisions taken during the last two years for L1 and L2 in school in the French-speaking and German-speaking cantons make these language issues a public relevant topic. It is known that for any project, the time of the implementation becomes a time of negotiations and adaptations not always planned, even more when it comes to implement the same project in different realities (Padiglia, 2008). Concerning the SOFT project, the material and its use has been adapted to the peculiar context of the Swiss classrooms. Furthermore, even if Swiss teachers are mostly already struggling since several years with reflections on the use and learning of L2 and are often already integrated in scientific projects (e.g., the linguistic immersion projects), the SOFT project had the particularity to extend the reflection to other languages, not only those advised by the cantons. This aspect was particularly important to show that learning a foreign language enables and facilitates the learning process of the mother tongue. As already said, the reality of Swiss French-speaking classes asked for adjustments of our pedagogical design. In fact, the formats were originally meant for small group, but in Switzerland teachers were mostly alone with the whole classes of twenty or more students. Despite this basic difficulty, the classroom's observations showed that pupils could gladly participate to the narrative format not only by repeating the dia-

logues and monologues of the stories, but also anticipating them.

At the beginning of the project, teachers shared their concerns about the implementation of the design in their classrooms (step 1), wondering if children and parents would really get involved. For example, a teacher of primary school, during an initial interview with the researchers, declared the following: *“I will be happy if all the children get in the active part with the language which is the most difficult thing in a classroom of more than twenty pupils. Another aspect is about the fact that it should go into the families, that it should take a larger dimension.”*

In the implementation of the pedagogical design, an interesting aspect to be highlighted is the fact that teachers not only wanted to apply the formats, but they really get involved in the implementation process, trying to find new modalities and create better conditions for social inclusion of a large set of children. In that sense, teachers of primary school developed a new way of performing the format: the leading of the story was not only done by the teacher, but “advanced” pupils were also invited to teach – by reading and performing the narrative format – young children of other classrooms. As effect, the young children immediately were involved in participating to the format activity, although they were not yet familiar with the Hocus and Lotus stories. During different recorded sessions in the classroom, pupils were free to give their opinion on the activities they led, showing a good comprehension of the modalities in which the stories were set: for example, a child of primary school expresses as follows his way to intend what means learning a foreign language: *“eh it's normal they (the characters of the stories) repeat because it's like that learning is working.”*

A relevant aspect in the implementation of the pedagogical design within the Swiss context concerns the benefits of parental involvement. As children received the material at home, it was possible to share it with their family. This has been an

important way to appropriate spaces that bridged schools and families, because parents and children could then be “immersed” in the pedagogical scenario usually created in the classroom, re-activating it outside the school. An example are the new modalities of repeating the format in informal environments such as during car trips or at dinnertime. A mother of a child of primary school declared the following: “*We (she and her daughter) were in the car and I have thought, I could have recorded this! [...] In the evening at table when my daughter has begun to repeat her sentences (about Hocus and Lotus stories) I have recorded it... We can also hear the cat and some other noises (laugh).*” Through these practices, social interactions within and outside the school become factors to promote integrative practices and the development of new linguistic skills. In fact, the development of children’s welfare and learning do not depend exclusively on individual factors and personal characteristics, but also on the quality of the contexts in which they live and interact. In turn, the children’s settings of life (school, family, peer group) are not independent from each other, rather they in-

fluence each other. The quality of these influences, the relationships between the various environments have an impact on the quality of children’s learning and development.

The parental involvement in children’s school experiences is a part of this educational process based on the partnership between the school and the family. These aspects are in line with evidences on children’s well-being and growth that have been produced by research in the field of psychology. The relations that take place at school between parents and teachers are then recognized as most responsible elements for the education of children (Padiglia & Arcidiacono, 2015).

Teaching a new language can be a bond of discussion between parents and teachers were everyone can share his/her own feelings and concerns. A mother of a child of primary school declared: “*the teacher was surprised... in a positive way... about the evolution of some children. At the beginning of the school year she (the teacher) said: “oh dear it will be difficult for some children”... but some children*

Name of the activity	People involved	Material needed	Goal of the activity
Guessing which character of H&L we are (a frog?)	- Teachers - Children - Parents	- A bag - A mirror - H&L characters (a frog, a duck...)	To involve parents in a dynamic play with children and teachers trying to find which character of H&L they are
<p>Operational description of the activity: The activity is performed in two times:</p> <ol style="list-style-type: none"> 1) After having performed the 1st Format in which every character of the story has been presented, the teacher gives to every child a toy representing a Hocus’ friend: the frog, the duck, etc... To the children having a duck she can ask: “are you a frog?” And the child answers, “No, I’m not a frog”... 2) In a second time, the teacher hides one of the character (so he/she tells) in a bag and ask the children to go and ask the parents to look in the bag and answer the question “are you a frog?” or “are you a duck?”...the parent checks what is in the bag and answers “No, I’m not a frog”... 3) At the end the teacher shows what was in the bag and the children discover a mirror (of the format 1 story). 			

surprised her in a good way at the end of the school year, they were not in difficulty with German at all."

A fundamental opportunity of social inclusion was the possibility to organize meetings with parents, children and teachers. During these occasions, parents were involved in co-organizing, with teachers and children, different activities in classroom. In the table below there is an example of activity created by teachers, children and parents during a meeting. The activity concerns the capacity to ask and answer (in a selected language) questions about characters (frog, duck, etc.) that are in different bags.

Several studies have shown how the involvement of parents in school living has beneficial effects on children's success (Epstein et al. 1997). The key components of the partnership between school and family are based on the capacity to share and negotiate rules, to balance educational styles and attitudes, and to participate in the school-family experiences in various forms (such as sharing choices and decisions, through dialogues, active participation and capacity to recognize and to value other's contribution).

Among the objectives of the SOFT project, shared activities between teachers, parents and children are the key elements to build a common space of socialization and integration. As lesson learned by this implementation, we will strive for transmission in time and we already have available teachers to integrate the education model proposed by the SOFT project as part of their school activities thereafter.

Discussion and conclusion

As presented in the theoretical framework, the SOFT project relied on three core elements: integration through social interaction; learning in context; and intersubjectivity. Language learning, as it has been conceived in this project, shows how the narrative formats only live through social interac-

tions, creating close social links in the classroom (through peer interactions or adult-child interactions), at home (with parents and/or siblings) and in home-school activities enabling shared spaces to foster social inclusion. As the pedagogical material we have implemented sustained these different types of social interaction, our design enabled to develop good communication practices and strengthen social relationships among participants. For example, children participating to the project have developed a stronger sense of alteration and intercultural differences, becoming, on the one hand, proud of their own origin and mother tongue (e.g., through direct questions to other pupils, such as "*Are you Italian? Me too!*"), and, on the other hand, developing a stronger interest in classmates own language (e.g., "*How do we say friend in Turkish?*"). Furthermore, the opportunities to strengthen the connection between families and schools have provided beneficial spaces for dialogue, also enabling the unity and potential improvement of the self-esteem of families, of their own identity and uniqueness, here considered as a positive resource by parents and by the school actors. In fact, some families coming from a minority ground often advise their own children not to speak the mother tongue, thinking that it could (negatively) interfere with the acquisition of the language of the host country. This shared space with families offered a concrete possibility to sustain their own language transmission, to share it with other parents, children and teachers, and to reflect on their own way of thinking about it. For example, a mother declared, during a meeting between teachers and parents, the following: "*I have learned new languages only by the written and visual way, but they (children) learn by listening... and all that they can hear, it's incredible! (...) We (the parents) have the reflex to think that for learning a new language we have to do written activities, but they (children) understand everything and they don't even know how to read! Incredible! So that's cool!*"

Last but not least, teachers have developed a more effective sense of comprehension of different

issues concerning integration. Notably, the creation of meeting opportunities relying on language issues has opened a new way of thinking the relationships with the parents, including them closely in the teaching/learning scenarios. The project also showed how learning is effectively *only learning in context*. In the design we used, every partner was taking advantages of different learning contexts, schools, families or in boundary-crossing these contexts and situations, creating “shared-spaces” as in school-families meetings or teacher-training activities. Every partner was developing learning skills that rely on these contexts and opportunities of mutual enrichment. The SOFT project finally showed how language learning relies on the capacity to create a common space where the co-construction of a shared meaning can arise, an *intersubjective* space which relies notably on the principle of good communication, postulating that the creation of an emotional bond among the conversational partners is essential to learn to speak a new language.

Besides what has been presented above, we would like to highlight few additional elements of pedagogical reflection. As seen, the SOFT project was aimed at providing benefits to all the various actors involved. In this sense, children using the peda-

gogical material in classroom and at home were developing skills usually related to the bilingual and multilingual cognitive advantages. On the parents’ side, an additional positive effect was that they were easily involved in the project and well-motivated to participate to school activities. They also were feeling invited to actively participate to their child’s language acquisition, through sharing relational and learning experiences in different contexts and occasions. Finally, on the teachers’ side, a strong positive issue relied on the fact that they have learned to create and develop different pedagogical scenarios involving school actors and families, promoting exchanges through collaborative, educational and linguistic skills. The teacher training sessions were an opportunity to sustain long life learning by sharing experiences with other colleagues of the school, where more experienced ones were reassuring or advising more inexperienced ones (including some teachers having some apprehension to change the own teaching style). We are aware that they will continue to transfer these good practices to new colleagues and that they will develop and adapt the pedagogical material with their future native and immigrant pupils.

References

- Arcidiacono, F. (2013). Conversation in educational contexts: School at home and home at school. In G. Marsico, K. Komatsu & A. Iannaccone (Eds.), *Crossing Boundaries. Intercontextual Dynamics between Family and School* (pp. 83-107). Charlotte, NC: Information Age Publishing.
- Arcidiacono, F. (2014). Plurilinguisme et enseignement des langues: une vision d’ensemble. In F. Arcidiacono (Ed.), *Hétérogénéité linguistique et culturelle dans le contexte scolaire* (pp. 11-25). Biel/Bienne: HEP-BEJUNE.
- Arcidiacono, F., & Gastaldi, F. G. M. (2011). “What do you say?” The analysis of classroom talk from a socio-cultural perspective. *Психологическая Наука и Образование / Psychological Science and Education*, 2, 1-15.
- Bialystok, E. (1986). Levels of bilingualism and levels of linguistic awareness. *Child Development*, 57, 498-510.
- Bruner, J. (1983). *Child’s talk: Learning to use language*. New York, NY: Norton.
- Bruner, J. (1998). *Le développement de l’enfant: savoir-faire, savoir dire*. Paris: Presses Universitaires de France.
- Epstein, J. L., Coates, L., Salinas, K. C., Sanders, M. G., & Simon, B. S. (1997). *School, family and community partnerships: Your handbook for action*. Thousand Oaks, CA: Corwin Press.

- Ghimenton, A. (2014). Les vertus cachées du bilinguisme. *Psychoscope*, 6, 12-15.
- Grosjean, F. (2013). Bilingualism: A short introduction. In F. Grosjean & L. Pi (Eds.), *The Psycholinguistics of Bilingualism* (pp. 5-25). Chichester: Wiley-Blackwell.
- Mackey, W. (2000). The description of bilingualism. In L. Wei (Ed.), *The Bilingualism Reader* (pp. 26-54). London: Routledge.
- Ochs, E. (1990). Misunderstanding children. In N. Coupland, H. Giles & J. Wieman (Eds.), *Handbook of Miscommunication* (pp. 44-60). Clevedon: Multilingual Matters.
- Ochs, E., & Schieffelin, B. B. (1984). Language acquisition and socialization: Three developmental stories. In R. Shweder & R. LeVine (Eds.), *Culture theory: Mind, self, and emotion* (pp. 276-320). Cambridge: Cambridge University Press.
- Padiglia, S. (2008). An integrative view of the observation of implementation in the different sites: From dream to reality. In B. B. Schwarz (Ed.), *ESCALATE's White Book on argumentation and enquiry-based science learning*. Jerusalem: Hebrew University of Jerusalem.
- Padiglia, S., & Arcidiacono, F. (2015). Towards integrative approaches through multilingual activities: Teachers, pupils and families experiencing a collaborative project. In M. Carmo (Ed.), *International Conference on Education and New Developments. Proceedings* (pp. 251-255). Lisbon: WIARS.
- Piaget, J. (1926). *The language and thought of the child*. London: Routledge.
- Pirchio, S., Taeschner, T., Passiatore, Y., & Tomasini, G. (2014). Gagner le défi de l'éducation bilingue: l'application du modèle du Format Narratif à l'école et en famille. In F. Arcidiacono (Ed.), *Hétérogénéité linguistique et culturelle dans le context scolaire* (pp. 47- 59). Biel/Bienne: Editions HEP-BEJUNE.
- Pontecorvo, C., & Arcidiacono, F. (2010). Development of reasoning through arguing in young children. *Культурно-Историческая Психология / Cultural-Historical Psychology*, 4, 19-29.
- Pontecorvo, C., & Arcidiacono, F. (2014). Social interactions in families and schools as contexts for the development of spaces of thinking. In T. Zittoun & A. Iannaccone (Eds.), *Activity of thinking in social spaces* (pp. 83-97). New York, NY: Nova Science Publishers.
- Resnick, L. B., Pontecorvo, C., & Säljö, R. (Eds.) (1997). *Discourse, Tools and Reasoning: Situated Cognition and Technologically Supported Environments*. Amsterdam: Springer.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York, NY: Oxford University Press.
- Schieffelin, B. B., & Ochs, E. (1986). *Language Socialization across Cultures*. Cambridge: Cambridge University Press.
- Sorace, A. (2007). The more, the merrier: Facts and beliefs about the bilingual mind. In S. Della Sala (Ed.), *Tall Tales about the Mind and the Brain: Separating Fact from Fiction* (pp. 193-203). Oxford: Oxford University Press.
- Taeschner, T. (Ed.) (2002). *L'insegnante magica*. Rome: Borla.
- Taeschner, T. (2003). *Il sole è femmina: uno studio sull'acquisizione del linguaggio in bambini bilingui*. Rome: DITI.
- Taeschner, T. (2005). *The magic teacher*. London: CILT.

- Taeschner, T., Rinaldi, P., Tagliatela, D., & Pirchio, S. (2008). Le parole per raccontarmi. Una ricerca sull'apprendimento dell'italiano da parte di adolescenti figli di immigrati. *Psicologia dell'educazione e della formazione*, 10 (1), 21-35.
- Valsiner, J. (1995). Editorial: Discourse complexes and relations between social sciences and societies. *Culture & Psychology*, 1, 411-422.
- Vygotskij, L. S. (1934). *Myslenie i rec'*. *Psichologiceskie issledovanija*. Moscow: Gosudarstvennoe Social'no-Ekonomiceskoe Izdatel'stvo. (English transl. *Thought and Language*. Cambridge: The MIT Press, 1962).
- Weinreich, U. (1968). *Languages in Contact*. The Hague: Mouton.
- Wertsch, J. V. (1985). *Culture, Communication and Cognition: Vygotskian Perspectives*. Cambridge: Cambridge University Press.

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Форма наратије осмишљена ради бољег усвајања језика кроз социјалну интеракцију

У овом раду представљамо истраживање које је посвећено осмишљавању могућности за учење и развој кроз социјалну интеракцију. Ова студија представља део ЕУ пројекта под називом СОФТ (School and family together for the immigrant children integration), а има за циљ бављење лингвистичком и социјалном инклузијом деце кроз активности у вези са учењем страног језика, којима се повезују породице и школе.

Културне и лингвистичке различитости се сматрају елементима који промовишу учење и сарадњу међу различитим учесницима у социјалној комуникацији: децом, наставницима, родитељима, истраживачима и школама. Заправо, ми обраћамо пажњу на образовне активности које се остварују кроз социјалну интеракцију и у којима културне и лингвистичке разноликости представљају корисне елементе који промовишу учење и сарадњу међу различитим учесницима у социјалној комуникацији.

У овом раду ћемо анализирати два аспекта нашег истраживања: 1) како педагошко истраживање под називом „форма наратије“ може да створи необичну социјалну интеракцију у учионици и како у развојној перспективи нуди праву могућност за побољшање когнитивних и социјалних вештина; 2) како социјална интеракција између школе и породица помаже наставницима, ученицима и родитељима да развију свест о својим улогама и да појачају сарадњу са социјалном инклузијом? Кроз презентацију образовног окружења, а касније и дискусију о томе, наша намера је да дамо одговоре на следећа истраживачка питања: како наставници спроводе педагошко истраживање ради укључивања деце у активности на страном језику; како форма наратије помаже деци да науче да говоре нови језик и како омогућава интеграцију наставника, ученика и родитеља?

Наш фокус је на лингвистичкој интеграцији деце кроз социјалну интеракцију која се заснива на усвајању језика кроз активности које повезују породице и школе, а у вези су са политичким и друштвеним контекстом у којем је и развијен наш пројекат. Питања која се тичу релевантности социјалне инклузије су веома актуелна у Швајцарској, јер се Швајцарска непрекидно суочава са све већом хетерогеношћу култура и језика који се говоре у школама. Језик се сматра средством социјалне инклузије у овој сложеној ситуацији у оквиру основних контекста образовања (као што су школе и породице) и као могући начин који води заснивању ефектне и инклузивне социјалне праксе. Сматрамо да је релевантно нагласити да наш интерес није искључиво заснован на нивоу језичке интеграције деце чији је то матерњи језик и деце имиграната кроз учење новог језика (укључујући језик земље домаћина). Напротив, претпостављамо да и школа и кућа представљају релеванте елементе за учење и матерњег и страног језика за децу мигранте.

Пројекат СОФТ је започео интердисциплинарни истраживачки тим, а полазна тачка је била заједничко интересовање за учење и поучавање језика у мултикултуралном контексту. Пројекат је покренуо многа питања, а централна питања и главни предмет су они који се тичу односа између школе и породице. Овај аспект је нарочито релевантан у смислу социјалне интеракције која одржава процес

учења и поучавања, јер укључује све извршиоце који учествују у контексту основног образовања, као што су породице и школе. Циљ овог рада није дискутовање о схватањима билингвизма и мултилингвизма, већ представљање педагошке форме наратије која је започета и која користи модел учења/поучавања језика са децом. Да бисмо користили форму наратије (и њене принципе) у учионици, развили смо пројекат који се састоји од сета педагошких материјала који се комбинују са различитим материјалима, а у то су укључени и деца и одарасли. У ову студију је било укључено петнаест наставника и сто шездесет деветоро деце (узроста од три до седам година), из два разреда основне школе и две групе из обданишта у Швајцарској, а активности су се тичале учења/поучавања енглеског и немачког језика. Три главна корака су била посвећена имплементацији пројеката: први је посвећен посебној обуци наставника; други корак развијању образовних активности у учионици, а трећи заједничким активностима породице и школе. Сакупили смо квалитативне податке, углавном преко интервјуа (аудио-снимци у фазама 1 и 2) и посматрање (етнографски записи и видео-снимци у корацима 2 и 3).

Резултати овог истраживања показују да пројекат који смо имплементирали може да створи услове који помажу и имитирају природну средину (неформалну, дискурзивну) за усвајање језика. Посматрања у учионици су показала да ученици учествују у форми наратије, не само понављајући различите дијалоге и монологе неких прича већ и активно учествујући. Добре стране имплементације педагошког пројекта у швајцарском контексту обухватају и укључивање родитеља. Животно окружење деце као што су школа, породица и вршњачка група нису независне једна од друге, већ имају утицаја једна на другу. Квалитет ових утицаја и односи између различитих окружења имају утицаја на квалитет учења деце и на развој. Родитељско укључивање у школски живот деце је део образовног процеса, који се заснива на партнерству између школе и породице.

Конечно, могућности које чине снажнијим везу између породица и школа су створиле простор за дијалог, омогућавајући јединство и потенцијално побољшање самопоуздања породица, њиховог идентитета и јединства, које се овде сматрају позитивним фактором и породица и учесника у школовању. Заправо, неке породице које потичу из мањинских популација често саветују децу да не говоре матерњим језиком, мислећи да то може имати негативни утицај на усвајање језика земље у којој живе. Ово се односи и на породице којима је понуђена могућност суздржавања од матерњег језика на којем би разговарали са другим родитељима, децом и наставницима.

Кључне речи: наративни формат, вишејезичност, социјална инклузија, интеракција између школе и породице.



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Challenges, obstacles and outcomes of applying inquiry method in primary school mathematics: example of an experienced teacher

Abstract: *This paper analyses the attempts of an experienced mathematics teacher to apply principles of inquiry based teaching in her practice upon receiving training on the topic. Results of the analysis of teacher's practices based on her reflective accounts, lesson plan forms and observations of videotaped lessons show that the teacher devotes very little time to non-instructional activities, while instructional ones are in line with activities presumed to be part of the inquiry approach. With respect to the particular Components of Inquiry difference between the two observed lessons was found for the Explain phase of the lesson, although both Explore and Explain phases were consistently coded as higher level order (e.g. students were focused on problem solving, combining and constructing new ideas). The process was also followed by appropriate discursive patterns. Results are discussed in the light of the training received and possible improvements to be made.*

Key words: *mathematics, inquiry based learning, teacher.*

Introduction

For the past two decades, there has been a clear push toward instructional practices that facilitate the active role of students in the process of learning along with their critical, deep order and divergent thinking. Although the model of inquiry essentially refers to science education (Rocard, Csermely, Jorde, Lenzen, Walberg-Henriksson & Hemmo, 2007) extensive efforts have been made to develop and confer inquiry to the mathematics domain (Ar-

tigue & Baptist, 2012). As to mathematics per se it has been acknowledged that for students to excel in the world nowadays they must be equipped to solve complex problems instead of just memorizing algorithms, definitions and directly applying knowledge that was gained (Friedman, 2005). The same notion is supported by *Programme for International Student Assessment (PISA)* and *Trends in International Mathematics and Science Study (TIMSS)* data. Despite the fact our students obtain higher than average results in the latter these also suggest our students struggling the most when it comes to those tasks that acquire thinking outside-of-the-box

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(Gašić-Pavišić & Stanković, 2012; Pavlović-Babić & Baucal, 2013).

The focus of the present study is to examine inquiry practices in mathematics of one experienced teacher in an urban school setting. We intend to explore whether the amount of time spent on various components of inquiry, the order that these components are presented to students and discursive patterns behind it can relate to the cognitive level at which students are expected to work and learn. The teacher's reflective accounts will also be taken into account, as to assess the way teachers perceives own practice in an attempt to apply the inquiry method.

Theoretical background

In one form or another learning always involves knowledge construction irrespective of the domain in which is taking place. Thus it is of the essence to explore which kind of instructional practices are likely to promote such knowledge construction. When one observes mathematics as a domain, often mathematics is perceived as a set of formulae to be applied to a list of problems. Such a "misconception" is largely developed thanks to the way in which mathematics is often taught (i.e. teacher demonstrating a method of calculation and students subsequently repeating it without reflection) (Artigue & Baptist, 2012). It is not surprising that for the past two decades we have been dealing with deliberative attempts to introduce more active teaching and learning methods in mathematics, along with a clear understanding of what makes some teachers more effective in introducing such practices than the others.

Inquiry based teaching in mathematics is among those approaches that focus on providing students with an active setting in which they are no longer passive recipients and consumers of knowledge. Rather, with the help of the teacher, they learn how to understand the concepts of mathematics, and not the mere mechanics of how to solve a cer-

tain problem. The teacher is there to provide each student with essential scaffolding based on the students' interest, readiness and ability, while students question, explore, observe, discover, assume, explain, and prove mathematical concepts, which forces them to think critically and analytically in the realm of mathematics (Tomlinson & McTighe, 2003). In Cobb's description of inquiry in mathematics, the classroom ideal would be the one positioning the teacher and students "*acting in and elaborating a taken-as-shared mathematical reality in the course of their ongoing negotiations of mathematical meanings*" (Cobb & Yackel, 1998, p. 163).

At the same time, inquiry based teaching does resonate with the values elicited in the problem-solving tradition (Polya, 1945), the Realistic Mathematics Education (Freudenthal, 1973), the Theory of Didactical Situations (Brousseau, 1997), the socio-cultural approaches and the idea of community of practice (Lave & Wenger, 1991) or the dialogical perspective (Bakhtin, 1981). To a certain degree, each of these approaches to mathematics education has something in common with the inquiry-based perspective, but each tends to shape its proposed values in its own particular way (Artigue, Dillon, Harlen & Lena, 2012).

Inquiry as a pedagogy is primarily associated with John Dewey (Dewey, 1938). In his opinion inquiry as a method offers the possibility for the everyday experiences to reinforce students' natural thinking, rather than attempting to restructure thinking on the basis of subject-specific knowledge. In his understanding, inquiry naturally happens in the context of '*ordinary-life experiences*', whilst subject knowledge serves only as a site for forming inquiry skills. However 'school context' inquiry is not necessarily like this. It does not have to start with everyday experiences. In mathematics, for example, a spur to inquiry can be a mathematical statement or an equation. If it is set just above the current knowledge of students, it can spark interest and questioning and encourage them to rise above themselves.

Although students are in such a case somehow displaced from their own comfort zones and 'provoked' in a Piagetian manner (Piaget, 1969; Piaget & Inhelder, 1978), it also allows them to perform in the zone where they can be challenged to think critically without being overwhelmed (Vygotsky, 1978). Scaffolding, one of the key elements of inquiry based learning, makes the learning more manageable for students by altering difficult and complex tasks in modes that make these tasks accessible, within the student's zone of proximal development (Vygotsky, 1978; Rogoff, 1990). Simultaneously an important feature of scaffolding is that it supports students' learning of both how to do the task, as well as why the task should be done following particular procedures. The latter is sometimes of key importance precisely for the domain of mathematics (Hmelo-Silver, 2006). Again irrespective of the domain, scaffolding facilitates problematizing important aspects of students' work in order to force them to engage with key disciplinary frameworks and strategies (Reiser, 2004).

The findings of several studies indicate that the application of an inquiry based approach in teaching has a positive impact on student achievement and motivation (e.g. GLEF, 2001; Hmelo-Silver, Duncan & Chinn, 2007). The method is also found to contribute to the development of creativity and independence of students as they become directly responsible for the outcome at the end of the process (Kühne, 1995). This equally applies to those students who need additional support in their daily classroom activities. Over the last couple of years, several large European projects were aiming to promote inquiry-based learning in mathematics classes (e.g. the Fibonacci project, PRIMAS - Promoting Inquiry in Mathematics and Science Education). As some of the survey reports indicate, inquiry-based learning has not found its way into daily teaching practice (PRIMAS, 2011). Teachers' doubts about inquiry relate to several issues such as the fact that inquiry, with its focus on everyday experiences and inductive learning, is not envisioned

as a genuine pedagogy for mathematics and some classroom level restraints on inquiry are commonly found (i.e. curriculum boundaries, students' lack of skills, classroom management issues).

However, in order for the meaningful inquiry to take place and to bring students investigations to a point of deep understanding regarding a key concept in the discipline, teachers need to be equipped to facilitate such investigations and to be able to analyse how to shape own practice in future inquiry endeavours.

Only a particular instructional move will help students to analyse instead of recall, to justify as an alternative to define, and to formulate instead of listing. In line with this, researchers and teacher trainers have developed theory-driven and empirically based design strategies for integrating effective scaffolding strategies to inquiry based learning (Hmelo-Silver, 2006; Quintana, Reiser, Davis, Krajcik, Fretz, Duncan, Kuza, Edelson & Soloway, 2004; Reiser, Tabak, Sandoval, Smith, Steinmuller, & Leone, 2001); yet in-service programs designed for disseminating inquiry-based teaching have been evaluated as producing varying results with regard to teachers' effective practices and further professional development (Nelson, 2009). Oliveira (2010) states how many short-term professional development programs provide incomplete information and fail to facilitate teachers' deeper understanding of classroom inquiries at the level originally intended. Oliveira further stresses the dynamic view of classroom inquiries and the need to take into account prior beliefs and practices of each teacher involved in such programmes along with their reflections on the process.

Most currently-used inquiry instructional models use a four component model (Eisenkraft, 2003; Bybee, Taylor, Gardner, Scotter, Powell, Westbrook & Landes, 2006; Marshall et al., 2009; Marshall & Horton, 2011), including: the *engage* phase (i.e. misconceptions and prior knowledge are exposed); the *explore* phase (i.e. learners actively investigate

scientific concepts); the *explain* phase (i.e. prior knowledge is combined with the ongoing learning process as to generate conceptual understanding); and the *extend* phase (i.e. learning is deepened and applied to new situations), often observed as an addition of the engaging and exploring stages. During all of these phases, students are expected to actively engage and make sense of the data they have gathered. The teacher is there to probe, question, and help draw the pieces together. Having in mind this framework, we intend to answer the following questions: (1) how does the order of instruction narrate to the time spent to *explore* and *explain* the components of the inquiry process? (2) how does the order of instruction organized by the teacher relate to the cognitive level displayed by students? “*explain*” and “*explore*” phases will be central to our inquiry. and (3) which discursive patterns are played during the “*explain*” stage performed by the students? All questions will be observed from the stand point of teacher practices and how these are shaped as to address the needs of students.

Methodology

The paper is part of a five year project titled “*From stimulating initiative, cooperation and creation in education to new roles and identities in society*”³, realized by the Institute for Educational research. The project is taking place in an elementary school in Belgrade (Serbia) where a new model of teaching and learning has been implemented by focusing on promotion and fostering creativity, initiative and cooperation in the classroom. The so called “Trefoil” platform has been thoroughly described in several publications (Šefer & Ševkušić, 2012; Šefer & Radišić, 2012; Komlenović & Šefer, 2013; Šefer, Stanković, Đerić & Džinović, 2015).

As part of the third year of the Project, the entire teaching staff in the above-mentioned school

received one year of training covering topics related to fostering creativity, cooperation and initiative in the classroom. After each instructional session, the teachers had two weeks to apply the concepts after which these were discussed in focus groups gathering teachers of the same subject. As part of the follow up activities, each teacher prepared a lesson plan with reflections on how he/she perceived the activities during the lesson. Some of the performed lessons were also videotaped upon receiving an approval by the teacher. Prior to implementation of training sessions, two lessons of all the school teaching staff were observed by two researchers.

Sample

The current research is a case study on practices of one experienced mathematics teacher and her attempts to apply inquiry based teaching in the two classes she was teaching. Both classes included 6th grade students (aged 12-13) and are taught the topic of congruence of triangles. In teacher’s accounts both classes are typical (N=20) with one distinction that in one of them she is the class teacher.

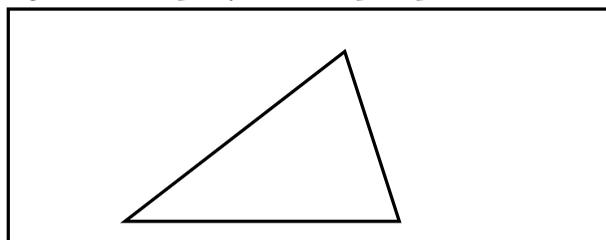
Lesson plan

The teacher’s lesson plan indicates the activities to be performed in groups. Each group received prompts as indicated below. The groups are heterogeneous with respect to school performance, composed of 3-4 students.. At the beginning of the lesson the teacher planned to use a Power Point presentation to introduce the topic, to give instruction to each group and to follow their work. The instruction for the students was to find as many ways possible to construct the same triangle as in the prompt they received. Each group has to check whether the constructed triangle is compatible to the original one. Each group has to present their own work and to discuss the solution, as well as the difficulties they had to overcome in the process. Criteria for ranking the group work included accuracy of the solution, the number of triangles constructed in differ-

3 Grant number 179034, Ministry of Education, Science and Technological Development

ent ways, the active participation of all students – the level of cooperation on the basis of monitoring activities. The highest rank mistake was considered to be construction of a triangle, which is not compatible with the one given in the prompt.

Figure 1. Example of a teacher prompt



The teacher also needed to provide the researchers with a short narrative on her perception of both lessons, what she considered to be exceptionally good, what kind of difficulties she encountered, and whether the lesson realization differed with reference to the initial lesson plan.

Videotaping procedures

Two lessons were videotaped, one per class. In both classes, the teacher applied the same teaching unit. In this way we were able to capture the teacher’s practices and to record possible differences with respect to the provided instruction. Recording was done using two cameras inside the classroom. One camera followed the teacher, while the other followed the interaction among students within the classroom. Ethical guidelines were fully followed during the recording and for each child parents’ consents were obtained. After the videotaping was conducted, a semi-structured “post lesson video stimulated interview” was planned with the teacher, but due to technical difficulties (i.e. teacher’s unavailability) these data are not available.

Instrument

Both classroom recordings were observed using the Electronic Quality of Inquiry Protocol (EQUIP; Marshall, Horton, Smart, & Llewellyn,

Figure 2. Inquiry and Student Thinking – Part of a descriptive section describing order of instruction

Construct measured	Non-instructional time (Level 0)	Pre-inquiry (Level 1)	Developing inquiry (Level 2)	Proficient inquiry (Level 3)	Exemplary inquiry (Level 4)
Order of Instruction	administrative tasks, handing back/collecting papers, general announcements, time away from instruction	teacher-centred, passive students, prescriptive, didactic discourse pattern, no inquiry attempt	teacher-centred with some active engagement of students, prescriptive though not entirely, mostly didactic with some open-ended discussions, teacher dominates the explanation, teacher seen as both giver of knowledge and facilitator, beginning of class warm-ups	largely student-centred, focus on students as active learners, inquiries are guided and include students’ input, discourse includes discussions that emphasize the process as much as the product, teacher facilitates learning and students activity at all stages, including the explanation phase	student-centred, students are active in constructing and understanding the content, rich teacher-student and student-student dialogues, teacher facilitates learning in effective ways to encourage students’ learning and conceptual development, assumptions and misconceptions are challenged by students and teacher

2008; Marshall, Horton, & White, 2009). The instrument was designed to measure the quantity and quality of inquiry instruction being implemented and provided an adequate validity (Marshall, Smart, & Horton, 2010). EQUIP measures 6 indicators at five-minute intervals (Activity, Organisation, Students attention to the Lesson, Cognitive, Inquiry

Instruction and Assessment) and then 19 indicators at the conclusion of the observation. The latter addresses four major constructs: Instruction, Discourse, Assessment, and Curriculum. For the analytical purposes of this paper, the *Order of Instruction* indicator under the Instruction construct was

Figure 3. Explanation of codes used to assess quality of inquiry (Marshall et al., 2008; Marshall, Horton, & White, 2009).

<i>Cognitive Level—displayed by students</i>	<i>Components of Inquiry—facilitated by teacher</i>
0. Other—e.g., classroom disruption, non-instructional portion of lesson, administrative activity	0. Non-inquiry: activities with the purpose of skill automation; rote memorization of facts; drill and practice; checking answers on homework, quizzes, or classwork with little or no explanation
1. Receipt of knowledge	1. Engage: typically situated at the beginning of the lesson; assessing student prior knowledge and misconceptions; stimulating student interest
2. Lower order (recall, remember, understand) and/or activities focused on completion exercises, computation	2. Explore: students investigate a new idea or concept
3. Apply (demonstrate, modify, compare) and/or activities focused on problem solving	3. Explain: teacher or students making sense of an idea or concept
4. Analyse/Evaluate (evidence, verify, analyse, justify, interpret)	4. Extend: students apply ideas to a new contextual setting or investigate concepts in greater depth
5. Create (combine, construct, develop, formulate)	

Figure 4. Explanation of codes used to assess discourse construct (Marshall et al., 2008; Marshall, Horton, & White, 2009).

<i>Construct Measured</i>	<i>Pre-inquiry (Level 1)</i>	<i>Developing inquiry (Level 2)</i>	<i>Proficient inquiry (Level 3)</i>	<i>Exemplary inquiry (Level 4)</i>
Communication Pattern	Communication was controlled and directed by teacher and followed a didactic pattern	Communication was typically controlled and directed by teacher with occasional input from other students; mostly didactic pattern	Communication was often conversational with some student questions guiding the discussion	Communication was consistently conversational with student questions often guiding the discussion
Classroom Interactions	Teacher accepted answers, correcting when necessary, but rarely followed-up with further probing	Teacher or another student occasionally followed-up student response with further low-level probe	Teacher or another student often followed-up response with engaging probe that required student to justify reasoning or evidence	Teacher consistently and effectively facilitated rich classroom dialogue where evidence, assumptions, and reasoning were challenged by teacher or other students

used (see Figure 2) to track the progression of the instruction, followed by the Discourse construct.

As for the indicators measured at five-minute intervals, two were central to this study: *Cognitive Level* of students and *Component of Inquiry* (see Figure 3). Following the coding a rough percent of time dedicated to each category (e.g., Explore, Explain) for both of the indicators was calculated⁴.

Discourse construct was observed focusing on two out of five possible segments. These included *communication patterns* and *classroom interaction pattern*. Taking into account the overall organization of the lessons, the questioning levels, the complexity of the questions and the questioning ecology were excluded from the analysis (Figure 4).

Results

In both classes the organisation of the lesson unfolds in the same manner. The teacher introduces the prompts, the students spend some time working in groups, and then results are presented to the whole class. However, while the length of the lesson in one of the classes is proportional to the usual instructional time in Serbia – 45 minutes, in the other the lesson is prolonged to 60 minutes. The teacher organizes the lessons between giving a whole class instruction and working in small groups. Both lessons were systematically coded as ‘80% or more of the students are attending to the lesson’ (i.e. most students are taking notes or looking at the teacher during lecture, writing on the worksheet, most students have volunteering ideas during a discussion and are engaged in small group discussions even without the presence of the teacher). In her post-lesson reflective accounts the teacher declares she was satisfied by the level of collaboration within the groups and that she noticed just a few disagreements be-

tween them. She also informs that the way the lesson unfolded was fully in line with her lesson plan.

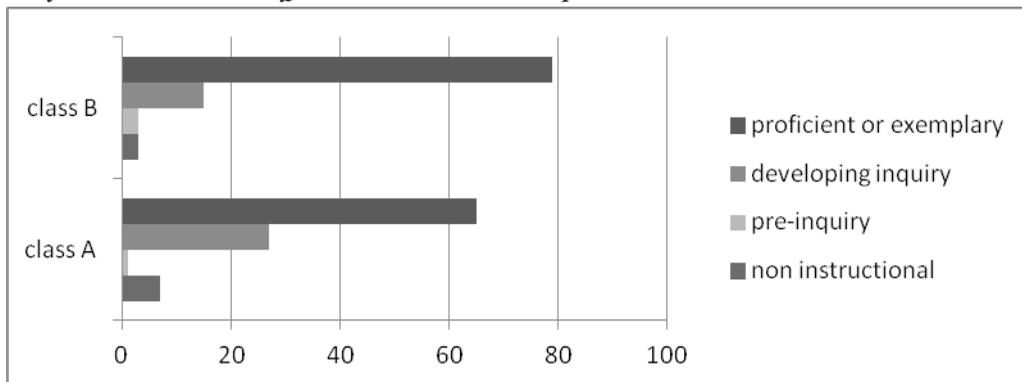
As for the *time spent on different components for the order of instruction construct* no differences in absolute time (counted in minutes) were found between the videotaped lessons and the non-instructional and pre-inquiry time (figure 5). Small differences are visible if we account for the proportion of time devoted to these components in reference to the full length of the lesson (45 minutes, class A; and 60 minutes, class B). Differences in both share of time and actual time devoted exist for the components developing inquiry and proficient-exemplary inquiry activities. Developing inquiry received more attention in class A, while proficient-exemplary inquiry activities received substantially more time in class B.

When the instruction provided opportunities for students to *engage* and *explore* concepts they were prompted with, a full explanation followed. Again, when students were involved in the explanation part of the lesson, these received a proficient rating or above (cf. indicators, levels 3 and/or 4, Figure 2). In both of the lessons the same observations were made and consistency in teacher practices was noted.

Following these observations, the differences between the two class groups on the percent of time devoted to different *Components of Inquiry* and on the *Cognitive Level* displayed by students were investigated as to deepen our understanding of the practices perceived on the videotaped lessons. No differences were noted between the two lessons (based on *Components of Inquiry*) regarding the time allocated for the Engage and Explore portions of the lesson, if we observe the actual time devoted to these activities. The time ratio in respect to the full length of the lesson does differ, but this can be attributed to the differences in the lesson length (45 vs. 60 minutes). The largest difference between the two observed lessons may be found in respect to the explanation portion of the lesson, 33% vs. 57% of the les-

⁴ Observations were also coded for the Activity, Organization, Students' attention to the Lesson and Assessment order. We will briefly mention it in the results' section.

Figure 5. Percent of time allocated to different instructional components

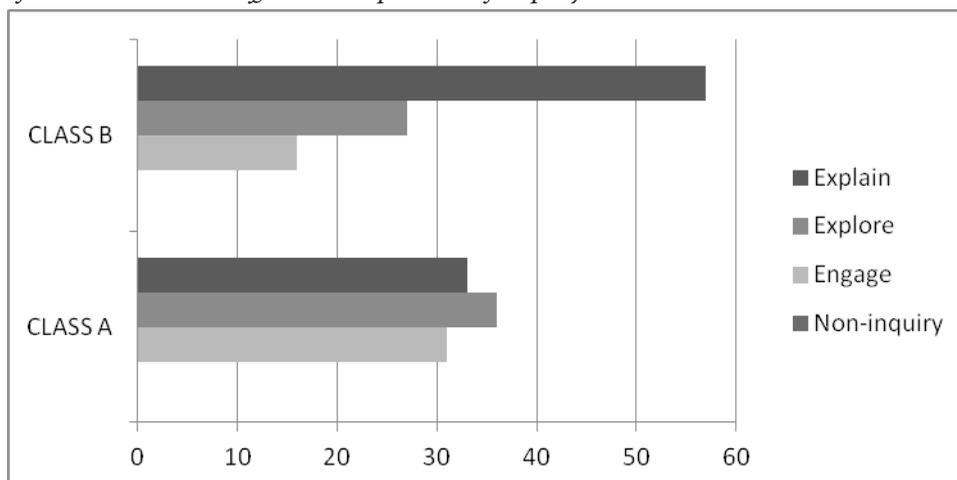


son time devoted to the activity (15 vs. 34 minutes). More time for the explanation phase was given to the students of the class B, despite the fact they have dealt with the same lesson topic and that the actual number of students does not differ between these two classes. Having in mind that this is the part of the lesson during which students are expected to actively engage in making sense of the concepts they have investigated, time allocation is equally as important as well as how that time is spent and managed by the teacher.

Cognitive Activity of Students allows for a deeper analysis of the latter aspect. The aspect was

coded for all students within the class, at five-minute intervals. In both lessons less than 5% of the total lesson time was coded for cognitive level 0 referring to classroom disruption, non-instructional portion of lesson and/or administrative activity. All these speak in favour of teacher keeping track of time and how that time is used. As for the parts of the lesson devoted to engage phase (figure 6), they were consistently coded for lower levels of cognitive codes, such as recall and remember information (e.g. procedures related to transmitting lines and angles). However all these could be clearly situated only at the beginning of the lesson when the teacher is devoted to facilitating engagement of her students.

Figure 6. Percent of time allocated to different components of inquiry



Nevertheless, already during the exploration parts of the videotaped lesson (i.e. students investigating a new idea or concept), activities were consistently coded in both classes as higher level order during which it was visible that students were focused on problem solving and combining and constructing new ideas, while the teacher was facilitating their activity. During that time the teacher was also monitoring and assessing students' progress. She was circulating around the class, probing for understanding and commenting as appropriate.

Higher level cognitive codes remained during the explain phase along with teacher's clear emphasis on students providing evidences, and to verify and justify own results. Several aspects of this part of the lesson were interesting for the focus of this study. In both lessons students were unaware of the actual time they would have for presenting their results. Even when they started exploring the concepts, no information of the given time was announced, but rather 2 minutes prior presentation teacher was announcing how much time they had left. From these actions it was clear the teacher was keeping track of time, but if we have in mind that part of the teacher's instruction related to the number of produced solutions, saying out loud how much time one has in disposal is for both the students and the teacher a useful one. For students this allows for planning of the activity within the given time constraints, while the teacher actually may be more effective in tracking how well students organize own activities.

In class B, 57% of lesson time was devoted to the Explain phase. This allowed for the groups not to be interrupted and to speak freely and without time constraints, on how they have investigated given concepts and which evidences they can provide to show that the solution they have found is the correct one. At the same time, this also allowed the teacher more time to deal with possible mistakes and misconception which may have risen in the process. We

present part of the presentation given by a group in the row, during the lesson in class B (Excerpt 1).

Excerpt 1. Example of students' presentations (class B)

1. Student 1: >ok here is the first idea< (.) °we haven't finished the second one°
evo ovako ovo je prva ideja (.) °drugu nismo za:vršili°
2. Teacher: not to me
sa:mo NE me:ni
3. Student 1: this is the angle (.) triangle (.) we were looking for ovo je ugao (.) trougao (.) koji smo tražili
[Turns omitted]
5. Student 1: so (.) we have transferred this line (.)that is (.) we transferred a line here (.) an arbitrary
o:vako (.) sa:da smo prvo preneli ovu duž (.)to je (.) jednu dužinu smo preneli ovde (.) proizvoljnu
6. Student 2: I mean we dra:w an arbitrary line (.) and we have measured it ((shows the prompt)) and we have tra:nsfe:rred it mislim na:cr:tali smo proizvodjnu polupravu (.)i izmerili ovu pravu ((pokazuje na crtež)) (.)i pre:ne:li je
7. Teacher: >in< sho:rt↑ (.) we have transferred a side of the train:gle (.) period↑
>ukratko< re:čeno↑ (.) preneli smo jednu stranicu tro:ugla (.) tačka↑
8. Student 1: **then** **Marija transferred this o:ne angle (.) from he:re and another from he:re (.) so we e:xte:nd the li:nes and ju:st (.) and the inte:rsection point we called a T ((a boy raises his hand))** and this right where the two: met (.) we marked the thi:rd angle (.) and we have proved it by overlapping the triangle against the li:ght

Ondaje Marija prenela ovaj je:dan ugao↑ (.) oda:vde I drugi oda:vde (.)pa smo pro:du:ži:li kra:ke i sa:mo (.) tačku pre:seka smo nazvali tačka T ((dečak podiže ruku))(.) I onda tu gde su nam se srele te dve: kad su se pre:sekle (.) tu smo iznačili tre:ći ugao (.) i to smo dokazali tako što kada preklopimo na sve:tlosti budu jednake

[Turns omitted]

9. Student 1: >no no< **we have this another idea we were not able to finish** (.) (.) if we had just improved it a little bit (.) these i:de:as (.) as we all had i:de:as >nije nije< imamo tu drugu ideju koju nismo uspeli da završimo(.) (.) malo da smo je samo usa:vršili (.) te i:de:je (.) jer smo svi imali i:de:je

10. Teacher: **what was the be:ginning idea here?**
a šta je po:četna tu i:dej:a↑?

11. Student 1: **we had a pro:blem in the first how to transfer the line (.) to fi:nd a way (.) then the other idea wa:s to dra:w a normal line (.) so: we didn't make it to the end (.)** if we agreed among ourselves (.) we have this angle i:mali smo pro:blem da pro:nađemo na:čin u prvom kako da prenesemo liniju (.) onda druga ideja jeste bi:la da povu:čemo normalu (.) o:vaj to nismo još sti:gli (.)da smo se do:g:ovorili (.) tu imamo taj ugao

12. Student 2: triangle
trougao

13. Student 1: triangle yes (.) then we wanted here to pull (.) li:ke this a norma:l line (.) and then here would normally be a 90° angle (.) and the:n (.) then we

could use this si:de which has these adja:cent angles (.) we could use it as the ce:ntreli:ne (.) and now a:ctually=

trougao da (.) onda smo ovde hteli da povu:čemo (.) o:vako jednu norma:lu (.)onda bi ovde normalno bio prav ugao (.) i sa:d (.) onda smo ovu stra:nicu na koju su ovi uglovi na:legli (.) mogli smo da koristimo kao sime:tra:lu (.) i sada u:stvari=

14. Teacher: =>wait wait<
centreline by? (.) a:ha↑ a:ngle:s =>čekaj čekaj< simetrala čega? (.) a:ha↑ uglo:va:

15. Student 1: yes and now (.) and here we put the divider (.)and here we ma:ke a bow (.) and then just tra:nsfer symmetrically here (.) and then when we connect we ge:t actua:lly these two e:qua:l (.) and we could prove it by overlapping it against the light on the wi:ndow da i sa:da(.) i ovde stavimo šestar (.) i tu na:pra:vimo lu:k (.) i onda samo pre:nesemo simetrično o:vde (.) i onda kada spojimo do:bijemo ustva:ri ta dva je:dna:ka↑ (.) a to bismo mogli da dokažemo tako što bismo prislonili papir na pro:zor

In the excerpt, student 1 takes over the presentation while the second one monitors her wording. Enough time was given to them to explain what they have done and also to include the second idea they formulated with in the ongoing explanation. However, in the way they organize their wording, one can also capture who actually took part in the process of discovering possible solutions. In this case, this was a joint endeavour as the students not only systematically use the 'we' positioning, but also inform their audience when a specific move is the

contribution of a particular group member – “then Marija transferred this one angle from here and another from here so we extended the lines and just (.) and the intersection point we called a T”.

These exchanges, at the level of existing communication patterns even when the conversation is somewhat directed by the teacher, were systematically coded at levels 3 and 4 - *proficient and exemplary inquiry*. The exchanges take conversational, dialectical mode with students guiding the discussion, most of the time. From an interactional point of view, teacher or students often followed-up the response with engaging probe that required students to justify reasoning or evidence.

In case of the class A, where the lesson takes the usual 45 minutes and only 15 minutes in all is given to all groups to present and explain their findings, higher cognitive levels have remained, although the exchange is more teacher-directed, thus changing to some level of existing interactional and communicational patterns. The time slot given to each group was much more restricted by the teacher, which raises the question how is then teacher able to address all the groups' misconceptions.

The teacher herself informs in her reflective accounts that she was pleased with how the lessons unfolded and that all students succeeded in resolving the assigned tasks. In her own view, each group provided at least one way concerning how to construct a triangle congruent to the given one. Some groups managed to perform all the three basic constructions of a triangle (the three side solution, two sides and the included angle solution and the two angles and included side solution). In her accounts she does not refer to the actual differences between the classes as to how much time they were then given to explain own results.

During the next lesson an individual assessment of all students was performed. The teacher concluded that all of them mastered the three-sided solution, whilst two sides and the included angle, as well as the two angles and included side so-

lutions were still problematic for six students within the two classes. In the teacher's experience, this teaching unit has been a difficult one when done in a formal way during which she usually explains each of the four theorems. Only in the case of the two angles and the non-included side solution, which is not considered an intuitive solution per se, students did not offer the solution during the observed lesson but many were tempted to find it especially when at the end of the lesson; the teacher did say that there was one additional solution to the task which did not appear during the students' presentation. The teacher perceived these succeeding attempts as the direct effect of enhanced motivation and the process during which students independently come up with solutions to the given problems.

There were several specific notes on the observed lessons the researchers received from the teacher. A particularly positive one was the fact that one group of students came up with a correct, but unusual solution. They applied their knowledge from last year and transferred the given symmetric triangle in relation to an axis of symmetry. Thus, they got a congruent triangle because, as the teacher noted, “it is known that the axisymmetric triangles are congruent because they have all the same elements.” The teacher perceived it as an exceptionally creative solution. She also noted that students would usually cut with scissors all the triangles they constructed and then “measure” whether these are the same or not. This was the first time they have thought to overlap the triangles against the light on the classroom window in order to check own solutions.

The difficulty the teacher refers to relates to the aspect of timing. She was aware that students had insufficient time to come up with several solutions to the given problems (*Explore* phase), and that, at the same moment, little time was given to analyse all the students' ideas and answers (*Explain* phase). However, she does not specifically tackle why she has prolonged only the lesson of the class B

and not of the class A, and whether the actual information given to the students on how much time exactly they have for each step of the process would reduce the stress exhibited by some students. The only remark that was formulated concerning the *Engage* part of the lesson. The teacher declared that in the next attempts she will try to decrease time for this part of the lesson, as well as to increase the *Explore* section. Although the engaging portion of the lesson (Engage phase) was used for the students to recall some important aspects and procedures they need to incorporate while finding the solution, she believes that students would encounter them even on their own and this would even enhance the elicited creative aspects of the inquiry process.

Discussion and conclusions

The focus of this study was on examining of inquiry practices in mathematics through the observation of an experienced teacher in an urban school setting. More particularly, we explored the amount of time spent on various components of inquiry, the order of presentation of these components, the students' discursive patterns behind it and the relation to the cognitive students' level while performing the activities in the light of the instruction provided by the teacher.

The analysis has shown that the teacher devotes very little time to non-instructional activities, while no differences were found with respect to the pre-inquiry portion of the lesson between the two classes. Differences were found for the components developing inquiry (more time in class A) and proficient-exemplary inquiry activities (more time in the class B). With respect to the particular *Components of Inquiry*, no differences were found in the two classes concerning the time allocated for the *Engage* and *Explore* portions of the lesson. The largest difference between the two observed lessons was found for the *Explain phase* of the lesson, 33% vs. 57% of the lesson time devoted to the activity (minutes 15

vs. 34 minutes), for the benefit of the students of the class B. At the same time, in both lessons less than 5% of the total lesson time was coded for *cognitive level 0*, referring to classroom disruption, non-instructional portion of the lesson and/or administrative activities. Sections of the lesson devoted to the *Engage* part were consistently coded for lower levels of cognitive codes, such as the recall and the remember information. During the *Explore* activities of the lesson (i.e. students investigating a new idea or concept), activities were consistently coded as higher level order during which it was observed that students were focused on problem solving, combining and constructing new ideas. Higher cognitive levels remained during the *Explain* phase as well.

Having in mind that among the goals of the professional development training programme, which all teachers in the school received, was to improve the quantity and quality of inquiry-based instruction implemented in the school across various subjects, the analysis showed that when instructional time included students' explorations, these were consistently associated to high *Cognitive Level* thinking and learning. This finding was the same regardless of the class involved. In both lessons there were very little low *Cognitive Level* forms of learning.

Despite the differences we found in the length of the *Explain* portion of the lesson, these seemed not to affect the *Cognitive Level* of students, despite this may have been expected. At the same time it should be noted that we have dealt here with a case study, while results of Marshal and Horton (2011) which included a larger sample of observed lessons, point exactly to that - a larger difference in the higher *Cognitive Level* skills such as verify, justify, develop, and formulate when more time was devoted to student exploration. However, what was noted even by the teacher in his study was the notion that little time was given for all of the phases and that when only one third of the lesson is given for the *Explain*

phase alone, this may decrease opportunities for all the students' misconceptions to be tackled.

The teacher also reports to be satisfied with how the group work took place and the way students within each group have taken responsibility for the construction of knowledge. Even at the level of wording used to describe this process in the *Explain* phase, students would actually emphasise how they have shared the activities. Thus, although the teacher was there to monitor the process and scaffold the work when necessary, scaffolding was also visible at the peer-to-peer level. Again all these aspects contributed to the exchange to take a conversational, dialectical mode between students and students and the teacher. In particular stages, students were guiding the discussion most of the time, whereas the teacher or another student often followed-up the response with engaging probe that required student to justify reasoning or evidence, which is very much in line with the Cobb's description of inquiry in mathematics ideal (Cobb & Yackel, 1998).

Despite the fact this was a qualitatively oriented study, we may underline a consistent relationship between the *Order of Instruction* that the teacher has used and the *Cognitive Level* at which students were engaged. When students were given an opportunity to *explore* the concepts prior to an *explanation*, they thought about the content and concepts more deeply. At the same time, they provided with a new solution to the given problem which they probably would not have reached if the lesson was organized in a more formal way (e.g. congruency of axisymmetric triangles, overlapping the triangles against the light on the classroom window to check for congruency). The teacher also informed that she was pleased with the level of acquired knowledge after the observed lessons. All these were in line with the previous findings related to application of inquiry based approach in teaching and its positive impact on student achievement and motivation (GLEF, 2001; Hmelo-Silver, Duncan & Chinn, 2007), and development of creativity and independence of stu-

dents (Kühne, 1995). Thus if creativity and critical thinking are the instructional goals, these results propose that teachers should deliberately provide opportunities for students to develop the ideas for themselves.

From the perspective of the professional development provided for the teachers it is important for them to receive a quality instruction on how to involve particular instructional moves in their own teaching, and also to receive feedback on the way they perceived the lesson did unfold (Oliveira, 2010). As per the teacher accounts in our case the *time* component was seen as an important obstacle in realising the lesson, while she also perceived some students to be under stress regarding whether they will complete the task on time. The teacher perceived not having sufficient time within the 45 minutes slot to possibly tackle all the students' misconceptions. One of the possible solutions offered for the time constraint issue, as the teacher suggested, is to decrease the *engaging* phase during the lesson.

However, as providers of professional development courses, we also received an important message when topic of *time* is included in the equation of how to conduct a quality instruction founded in inquiry approach. For the teacher trainers this means not only to train teachers on how to perform specific instructional moves, but also how to perform these within the time slots available to them, such as the 45 minutes lesson time. It is of equal importance to nurture open space for discovery within the class at the sheer level of establishing basic ground rules for activities to be performed. This means that for each step the teacher has planned to guide during the lesson time constraints need to be known by the students (e.g. you have 10 minutes to explore the prompts). In this way clear flow is maintained while lessening the stress students may experience due to the fact they do not know how much time they still have for solving the problems or exploring new solutions.

Our results are based on a limited sample that is only a case study of an experienced mathematics

teacher in an urban elementary school with whom the researchers had been working during the previous school year. The overall goal was to improve the quantity and quality of the inquiry-based instruction being facilitated in the school through various subjects. Thus, it is to be explored whether current results hold true for other grade levels and subject areas, as well as the teachers who have not been

wrapped up in an inquiry based instruction. Nonetheless, when the goal is to engage students at deeper *cognitive levels*, teachers may be instructed to provide sufficient time for their students to *explore* real-world problems prior to them (or their students) *explaining* the underlying concepts.

References

- Artigue, M. & Baptist, P. (2012). *Inquiry in Mathematics Education*. Bruxelles: European Commission.
- Artigue, M., Dillon, J., Harlen, W., & Léna, P. (2012). *Learning Through Inquiry*. Bruxelles: European Commission.
- Bakhtin, M. (1981). *The dialogic imagination: Four essays by M.M. Bakhtin*. Austin: University of Texas Press.
- Brousseau, G. (1997). *Theory of didactical situations in mathematics*. Dordrecht: Kluwer.
- Bybee, R.W., Taylor, J. A., Gardner, A., Scotter, P. V., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins, effectiveness, and applications*. Colorado Springs: BSCSo.
- Cobb, P., & Yackel, E. (1998). A Constructivist Perspective on the Culture of the Mathematics Classroom. In F. Seeger, J. Voigt & U. Waschescio (Eds.), *The Culture of the Mathematics Classroom* (pp. 158–190). Cambridge: Cambridge University Press.
- Dewey, J. (1938). *Logic: The theory of inquiry*. New York: Holt.
- Eisenkraft, A. (2003). Expanding the 5E model: A proposed 7E model emphasizes “transfer of learning” and the importance of eliciting prior understanding. *The Science Teacher*, 70, 56–59.
- Freudenthal, H. (1973). *Mathematics as an educational task*. Dordrecht: Kluwer Academic Publishers.
- Friedman, T. (2005). *The world is flat: A brief history of the twenty-first century*. New York: Farrar, Straus and Giroux.
- Gašić-Pavišić, S. & Stanković, D. (2012). Obrazovna postignuća učenika iz Srbije u istraživanju TIMSS 2011. *Zbornik Instituta za pedagoška istraživanja*, 44(2), 243–265.
- GLEF (George Lucas Educational Foundation). (2001). Project-based learning research. *Edutopia online*. [retrieved 10.10.2012., URL: http://www.glef.org/php/article.php?id=Art_887]
- Hmelo-Silver, C. E. (2006). Design principles for scaffolding technologybased inquiry. In A. M. O’Donnell, C. E., Hmelo-Silver & G. Erkens (Eds.), *Collaborative reasoning, learning and technology* (pp. 147–170). Mahwah: Erlbaum.
- Hmelo-Silver, C. E., Duncan, R. & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark(2006). *Educational Psychologist*, 42(2), 99–107.
- Komlenović, Đ. & Šefer, J. (Eds.). (2013). *Stvaralaštvo, inicijativa i saradnja u nastavnim predmetima, III deo*. Belgrade: Institut za pedagoška istraživanja.

- Kühne, B. (1995). The Barkestorp project: Investigating school library use. *School Libraries Worldwide*, 1(1), 13–27.
- Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Marshall, J. C., Horton, B., Smart, J., & Llewellyn, D. (2008). *EQUIP: Electronic Quality of Inquiry Protocol*. [Retrieved from Clemson University's Inquiry in Motion Institute, www.clemson.edu/iim.]
- Marshall, J. C., & Horton, R. M. (2011). The Relationship of Teacher-Facilitated, Inquiry-Based Instruction to Student Higher-Order Thinking. *School Science and Mathematics*, 111(3), 93–101.
- Marshall, J. C., Horton, B., & White, C. (2009). EQUIPPing teachers: A protocol to guide and improve inquiry-based instruction. *The Science Teacher*, 76, 46–53.
- Marshall, J. C., Smart, J., & Horton, R. M. (2010). The design and validation of EQUIP: An instrument to assess inquiry-based instruction. *International Journal of Science and Mathematics Education*, 8, 299–321.
- Nelson, T. H. (2009). Teachers' collaborative inquiry and professional growth: Should we be optimistic? *Science Education*, 93(3), 548–580.
- Oliveira, A. W. (2010). Improving teacher questioning in science inquiry discussions through professional development. *Journal of Research in Science Teaching*, 47(4), 422–453.
- Pavlović-Babić, D., & Baucal, A. (2013). *Podrži me, Inspiriši me, PISA 2012 u Srbiji: Prvi rezultati*. Belgrade: Institut za psihologiju.
- Piaget, J. (1969). *Intellectual Operations and Their Development*. New York: Basic Books.
- Piaget, J. & Inhelder, B. (1978). *Intelektualni razvoj deteta*. Belgrade: Zavod za udžbenike i nastavna sredstva.
- Polya G. (1945, 2004). *How to Solve it?* New Jersey: Princeton University Press.
- PRIMAS (2011). *Survey report on inquirybased learning and teaching in Europe*. European Commission. [available at <http://www.primas-project.eu/servlet/supportBinaryFiles?referenceId=8&supportId=1247>]
- Quintana, C., Reiser, B. J., Davis, E. A., Krajcik, J., Fretz, E., Duncan, R. G., Kuza, E., Edelson, D., & Soloway, E. (2004). A scaffolding design framework for software to support science inquiry. *Journal of the Learning Sciences*, 13, 337–386.
- Reiser, B. J. (2004). Scaffolding complex learning: The mechanisms of structuring and problematizing student work. *Journal of the Learning Sciences*, 13, 273–304.
- Reiser, B. J., Tabak, I., Sandoval, W. A., Smith, B. K., Steinmuller, F., & Leone, A. J. (2001). BGuILE: Strategic and conceptual scaffolds for scientific inquiry in biology classrooms. In S. M. Carver & D. Klahr (Eds.), *Cognition and instruction: Twenty-five years of progress* (pp. 263–305). Mahwah: Erlbaum.
- Rocard, M., Csermely, P., Jorde, D., Lenzen, D., Walberg-Henriksson, H., & Hemmo, V. (2007). *Scientific education now: a renewed pedagogy for the future of Europe*. Bruxelles: Commission Européenne, Direction générale de la recherche, Science, économie et société.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Šefer, J., & Radišić, J. (Eds.) (2012). *Stvaralaštvo, inicijativa i saradnja, Implikacije za obrazovnu praksu, II deo*. Belgrade: Institut za pedagoška istraživanja.

- Šefer, J., & Ševkušić, S. (Eds.) (2012). *Stvaralaštvo, inicijativa i saradnja, Novi pristup obrazovanju, I deo*. Belgrade: Institut za pedagoška istraživanja.
- Šefer, J., Stanković, D., Đerić, I., & Džinović, V. (Eds.) (2015). *Pedagoški pristup Trojst: Podsticaj za stvaralaštvo, saradnju i inicijativu – Priručnik za nastavnike*. Belgrade: Institut za pedagoška istraživanja, Zavod za unapređivanje obrazovanja i vaspitanja.
- Tomlinson, C. A., & McTighe, J. (2003). *Integrating differentiated instruction and understanding by design*. Alexandria: Association for Supervision and Curriculum Development.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

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Изазови, препреке и исходи примене истраживачког приступа у настави математике у основној школи – пример искусног наставника

У протекле две деценије велики значај придат је праксама поучавања које промовишу активну улогу ученика у процесу учења, те развоју критичког и дивергентног мишљења у наставном процесу. Иако је истраживачки приступ у настави потекао из наставе природних наука, током претходног периода учињени су значајни напори да му се нађе примена и у настави математике. У фокусу овог рада је испитивање пракси наставника током примене истраживачког приступа у настави математике у једној основној школи. Испитивали смо да ли се време проведено током различитих корака у истраживачком раду (представљених ученицима) и обрасци дискурса током процеса истраживања могу довести у везу са когнитивном активацијом ученика на часовима математике у два одељења у којима наставница предаје, те како наставник опажа сопствену праксу када примењује овај приступ у раду. За потребе овог истраживања снимљена су два часа математике у два одељења шестог разреда. Наставна јединица била је иста у оба одељења. Планом часа предвиђен је рад у групама, а инструкцијом се подразумевало да ученици пронађу што више начина да конструишу троугао према задатим параметрима, своју конструкцију упореде са оригиналним троуглом који су добили у листићу за рад, и да, на крају, свака група представи своја решења, уз образложење како су извршили конструкцију и доказали подударност троуглова. Оба часа анализирана су помоћу „Electronic Quality of Inquiry Protocol“ (EQUIP), креираног да прати квалитет и квантитет инструкције за време истраживачког рада. Инструмент мери шест димензија (активности, организацију, пажњу ученика, когницију, инструкцију и процену), а након посматрања је могуће описати час са преко деветнаест индикатора који се распоређују у четири конструкта – инструкција, дискурс, процена и курикулум. Индикаторни ток инструкције (когнитивни ниво и компоненте истраживачког рада) и дискурс (комуникациони

обрасци и интеракција на часу) коришћени су за праћење напретка током часова. Када је реч о моделу поучавања у примени истраживачког рада у настави, коришћен је модел четири компоненте: укључи, истражи, објасни и прошири (engage, explore, explain i extend), са фокусом на прве три компоненте. Овај модел садржан је и у примењеном опсервационом протоколу.

Анализа је указала да наставница посвећује изузетно мало времена током часа активностима који немају везе са поучавањем (на пример, администрација), те да је највећи део часа посвећен активностима које директно укључују ученика у процес учења. У односу на референтни оквир примењених корака током истраживачког рада, нису пронађене разлике између одељења у погледу компоненти укључи и истражи. Највећа разлика уочена је током фазе часа објасни. Док је 33% часа посвећено овој активности у једном одељењу, чак 57% времена посвећено је истој у другом одељењу. Компоненте истражи и објасни су континуирано оцењиване високо спрам нивоа опажене когнитивне активације. То значи да су ученици активно истраживали сопствене идеје и концепте и пружали јасна објашњења, утемељена на примерима како су као група дошли до одређеног решења. Анализа комуникацијских образаца на часу подржава овај налаз. Наставница извештава да је задовољна начином на који су ученици учествовали у часу, креирали заједничко разумевање, али и стеченим знањем спрам циљева саме наставне јединице (подударност троуглова).

Даља анализа резултата стављена је у функцију унапређења процеса професионалног усавршавања кроз које је наставница прошла заједно са колегама из школе у којој ради, с обзиром на то да је овај рад део једногодишњег процеса обучавања наставника у истој школи, а које је спроводио Институт за педагошка истраживања из Београда. Анализа појединих пракси наставника, када је конкретно реч о примени истраживачког рада у настави, указала је на потребу унапређења поменутог програма за наставнике у погледу њиховог даљег обучавања како да руководе временом на часу (оквир од четрдесет и пет минута) и омогуће квалитетно одвијање свих компоненти истраживачког рада, а нарочито оног дела који се односи на објашњења ученика.

Кључне речи: математика, истраживачки приступ у настави, наставник.

Original paper

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From innovative teacher education to creative pedagogical designs

Abstract: *This contribution is about the design of innovative teaching practices. Innovation is fostered by a focus on creative tasks for school pupils, and supported by teacher education courses. Two examples of teacher education practice are presented, both requiring from student teachers to produce innovative pedagogical designs. A pedagogical design is defined by a specific set of tasks, by a social setting and by a sequence. The first example requires pedagogical designs offering a thinking space to learners, while the second example is based on an iterative research methodology (PIO).*

The discussion of these two examples stresses two features of these practices, that can be considered supporting creativity and agency in classroom activities: the anticipation and confrontation between prediction and observation, and the articulation of collective and solitary moments of work in specific sequences. Future research could investigate the potential support the various combinations of collective and solitary moments of activity offer to creativity. These combinations can be designed for teaching practices to fit specific pedagogical and learning objectives, and can be evaluated through micro-design research.

Key words: *creativity, collaboration, innovation, pedagogical design, teacher education.*

Introduction

In this paper, we examine the potential for encouraging innovative school practices through *pedagogical design*, building on a few elements from the literature on creativity. Teachers are invited to design lessons for their pupils in elementary or secondary schools which focus on creative tasks. Still, the teachers' activity consisting in designing their

teaching is also a creative task which can be used in teacher education for encouraging innovative teaching practices. To differentiate the design by teachers for school, college or high-school, and the courses designed by teacher educators for teacher education, *pedagogical design* will be reserved to the former. We will illustrate the potential for innovation with two *teacher education practices* inviting teachers to elaborate and put into practice innovative *pedagogical designs* including creative school tasks.

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The first section of the paper defines briefly creativity and innovation, and stresses the importance of creativity for future school practices. The next section examines the articulation between innovation and design, and sketches the potential of pedagogical and teacher education designs for new practices in teaching. The third section is dedicated to the presentation of two teacher education designs illustrating the potential for innovative teaching practices. The fourth and last section is a critical discussion of both designs presented in the paper, stressing a few relevant elements for fostering creative involvement of students or pupils.

Creativity for innovative teaching practices

What can be considered *innovative* in teaching? Recent educational changes in various countries have associated pedagogical innovations with cross-curricular competencies, such as social and communicative skills, meta-cognitive skills, reasoning and creative thinking. The new cross-curricular competencies are developed simultaneously to domain-specific knowledge and skills. For instance, a pupil writing a new text, drawing a picture, composing music, or solving a problem has the opportunity to learn domain-specific content and to develop cross-curricular competencies. Given that the general cross-curricular competencies such as “creative thinking” are rarely the main focus of teaching practices at school, teaching practice focusing on cross-curricular competencies can be considered *innovative*. Indeed, *innovation* can be defined as new ideas, products or practices by an individual or group within a specific social system (Rogers & Shoemaker, 1971). The fact that teaching practices focusing on cross-curricular competencies are often considered a challenge for pupils, teachers, teacher educators and researchers, leads us to consider the development of such teaching practices an innovation.

Among the various cross-curricular competencies, we will focus in this paper on *creative*

thinking, or *creativity*. The definition of *creativity* is relative to a specific field or context (Amabile, 1993/1996; Gardner, 2001; Mayer, 1999), which determines what is novel and relevant. Yet, *creativity* also refers to a psychological process, related to play, imagination, fantasy, feelings and emotions, meaning making and the use of symbols (Vygotsky, 1925/1971; John-Steiner et al., 2010). In addition to the individual psychological approach to creativity, various creative practices can be investigated as collective, as part of collaborative, communicative, and cultural practices. Inspired from previous studies (Miell & Littleton, 2008; Moran & John-Steiner, 2004; Sawyer, 2008), we will discuss more specifically the link between *collaboration* and *creativity* (Giglio, 2014). Collaborative tasks often involve the production of new ideas. These new ideas can be considered learning gains, or considered only as a production (Giglio & Perret-Clermont, 2010). Teachers can attempt to design their lessons in a way that learners confront their ideas in a creative way. Yet, teachers need to design the pupil’s tasks specifically to foster both creativity and learning (Vygotsky, 1925/1971; 1930/2004; 1931/1994). Research on the socio-cognitive conflict shows that such situations of confrontation of ideas among peers can be beneficial for learning, under certain specific conditions (Perret-Clermont, 1980; Doise & Mugny, 1981; Littleton & Howe, 2010), and even when none of the peers have succeeded in the task individually before the interaction (Schwarz et al., 2008).

Developing innovative teaching practices within teacher education

How can we foster *innovation* by teachers, in particular in the objective of developing cross-curricular competencies such as creativity and collaboration? Focusing pedagogical designs on creativity is obviously not sufficient to bring innovation in teaching practices. The systematic program of research about the social psychology of creativity by

Simonton (1997) shows the potential influences of history, culture, society, and biographic conditions on creative production. The intention governing a design can be forgotten, ignored or misunderstood by teachers and pupils when performing the actual activities, revealing a gap between the pedagogical intentions and the practices (Berman et al., 1991; Giglio et al., 2014). There are various ways to foster innovation. Cros (1996) distinguishes between innovation as education and reform, stating that innovation emerges bottom-up from practitioners, while reform is generally imposed by authorities and governments, leading to a well-known resistance and transformation of the initial intentions. Our approach to innovation is educational: It consists in offering opportunities to student teachers² for designing and putting into practice new ways of teaching, based on their own choices and preferences.

The long-term objective of this approach is to offer creative workplaces which can become innovative workforces involving multi-levels collaborations (employee-employers, practitioner-researcher, ...). It is an approach leaning towards social change based on the individual practitioners' creativity which can be used in educational and institutional organizations (Amabile, 1993/1996), which might be expected not to lead to the gap we mentioned above between the pedagogical intentions and the actual new practices. The desired social change is a reciprocal influence between creative experiment in teacher education and teaching experience within school and workplaces situations, which is dialogically impacting the historical and socio-cultural evolution of professional practice in teaching and teacher education. From this perspective we consider it possible to contribute to innovation in teaching with practices in teacher education focusing on creative pedagogical design (Gi-

glio, 2014). In order to develop a dialogue between professional traditions and specific innovations, inviting the individual teachers to participate in defining the content of the innovative practices as well as to engage in their own creative thinking. The focus on pedagogical designs for innovation is an operational choice of this approach to social change because they can become *boundary objects* (Kohler et al., 2015), if they are collaboratively elaborated and considered relevant to the work practice by the various participants. Pedagogical designs can support innovative teaching because they can function as *half-baked objects* (Kohler et al., 2015) into which researchers, teacher educators, teachers and pupils engage their creativity when taking it up and modifying it.

In order to offer a space and some resources to student teachers for developing innovative pedagogical designs, we have set teacher education courses or workshops requiring student teachers to elaborate and/or adapt pedagogical designs. The pedagogical designs elaborated by the student teachers should, in turn, offer opportunities for school pupils to engage into creative school task.

Two examples of teacher education practice fostering innovation by student teachers

A few theoretical elements have been presented which have inspired the work on *pedagogical designs* and the focus on creativity. We will now present two examples of teacher education practice made for offering space and resources to student teachers to develop innovative pedagogical designs based on creativity. For each example of practice we will describe the tasks proposed to the students by the teacher educator, the settings and the sequence.

² *Student teachers* refers here to students attending courses and seminars at a teacher education university and simultaneously being supervised during teaching practice at local schools where they are trainees.

First example: Developing pedagogical design offering a thinking space

The teacher education practice presented here is inspired by Perret-Clermont's work on the notion of *thinking space* (Perret-Clermont, 1991, 2001; Psaltis et al., 2015) and was elaborated in 2013 for student teachers, working in the capacity of trainees in secondary schools, college or high-schools/vocational schools. It is briefly presented below and followed by one example of the educational design elaborated by the students.

The course was spread over a full academic year and consisted of nine sessions, 3 hours each, with 15 to 20 student teachers from various domains (French, geography, history, arts, science...). The main task is to elaborate a *pedagogical design offering a thinking space* (Mehmeti & Perret-Clermont, 2015). Briefly, it means that the pedagogical design should aim at having school pupils engaging into genuine reasoning, learning or creative thinking. Student teachers were totally free to design their own experimental lesson, both for the domain-specific content, tasks and the pedagogical setting, and were explicitly invited to be creative and innovative, and to avoid the mere repetition of well-known school practices.

In order to provide student teachers with the intentions of such a pedagogical design, and with resources to create one, the first phase of the course consisted in frontal teaching from the teacher educator, reading assignments, collaborative analysis of school materials and tasks, dialogues and plenary discussions. The following themes were more specifically studied³, as resources for designing a *thinking space*:

- the distinction between *teaching* and *learning* (Tiberghien, 1997), notably for students to distinguish between their pedagogical in-

tentions and the effective learning gains of pupils;

- the issue of co-constructing an *inter-subjectivity* (Grossen, 1988, 1999) between the teacher and the pupils;
- the importance of the construction of the *milieu* (Brousseau, 1998/2004) for learners to engage into creative thinking various *strategies* learners can adopt in order to fulfil the tasks they received from the teacher, while avoiding the hard cognitive work required for learning (Perrenoud, 1994);
- the notion of *decontextualisation* (Perret-Clermont et al., 1982) to conceptualize the transformation of knowledge due to its *transposition* into school practices.

Additionally, student teachers were provided with a procedure adapted from the *didactic engineering* (Artigue, 1990), to support the design and the self-evaluation of their lesson. The procedure consists in four steps, briefly presented below:

1. the *preliminary analysis* of the context, to which the pedagogical design is addressed, including known issue and challenges for the chosen teaching content;
2. the *a priori analysis* of the pedagogical design, which includes the description of the pedagogical design alongside with reasons supporting the designer's choices, in terms of teaching objectives, expected learning gains, and so on;
3. the *experimentation* of the pedagogical design, i.e. the experience of putting it into practice;
4. the *a posteriori analysis* which consists in a discussion of the expectation and choices described in the a priori analysis, in contrast with the experimentation of the pedagogical design and any feed-back from the participants.

At the end of this first phase, student teachers had produced a description of an educational de-

³ The concepts and theories taught to the students are not presented here as it would be too long for the present paper. The references are provided for more information.

sign for a 45 minutes lesson in their own teaching domain, including descriptions about their expected outcome.

During the second phase, the student teachers put into practice the lesson they designed in a role-playing activity with the other students and the teacher educator, who were playing the role of school or college pupils. The interpretation of the pupils is supported by a customized choice of two learner's strategies defined on a character sheet, which confronts the pedagogical design to various classical strategies leading pupils to disengage from the activity.

The teacher educator took the role of a teacher and put into practice a first lesson, in order to provide an opportunity for students to practice their pupils' role a first time. The lesson designed by the teacher educator was provided as an example of a *pedagogical design offering a thinking space.*, and was based on research results discussing how to introduce argumentation in science teaching (Leitão, 2000 ; Osborne et al., 2001 ; Schwarz et al., 2003 ; Muller Mirza & Perret-Clermont, 2009). However, this example was not provided as a model for students to imitate, nor as a recommendation to include argumentation in their pedagogical designs.

After the practice, student teachers received extensive feedback about their lesson based on their experience as pupils, and on their suggestions, critique and comments regarding the given example, and their thoughts from a teacher's and teacher educator's point of view. Drawing from this feedback, student teachers had to submit a report for the evaluation of the course, where they provided a synthetic evaluation of the pedagogical design and recommendations for improving it.

We will now present a brief description of a pedagogical design elaborated by a student teacher during this course. This design is intended for a class in biology at college or high-school.

- The teacher sets the class in groups of 3-4 pupils and provides each group with a large

blank paper sheet, a map of the Galapagos islands and many cards with a picture of a bird and a few lines on various species (on which island it is often found, where it nests, what it eats, the difference of colors between male and female, ...). The given task expects the pupils to classify the various species of birds according to criteria freely chosen by the pupils. The classification can be done on the blank sheet, and should represent a tree-diagram built with a selected criterion for each bifurcation, and with only two branches at each level.

- When ready, each group presents the classification of the various birds and orally defends their work justifying the choice of criteria, and the level at which the criteria has been used. After all the presentations, a discussion is engaged identifying which group has the best solution. This discussion, as well as the rest of the activity is truly open and the teacher does not bring a final "correct" solution. As the final part of the pedagogical design, the teacher presents various solutions from biologists to the very same task, reproducing scientists' models of these particular bird species at a given time in the history of science. The attention of the pupils is drawn on the specificities of each classification, and not on the supposed-to-be correct and final answer. The method used in 21st century biology with genetic analysis, is brought into the pupils spontaneous discussion about their work and results.

After trying the pedagogical design in the role-play, the student teachers adapted minor elements of the design (the number of pupils per group, the time left for each phase, some oral instructions) in order for them to use it with a class at college or high-school, a year later.

Second example: The Predicting, Implementing and Observing method (PIO) for developing pedagogical designs

The second example of teacher education practice presented below, is based on a method called “PIO: Predicting, Implementing and Observing” (Giglio & Perret-Clermont, 2012; Giglio, 2015). This method was elaborated within the broader objective to take advantage of the articulation of research and practice in the context of teacher education, following recent studies in social psychology of cognitive development (Perret-Clermont, Carugati & Oates, 2004), and Activity Theory (Engeström, 1987; Engeström et al., 1999; Damsa & Ludvigsen, 2011). According to Giglio (2014) when student teachers alternate roles, between practitioner and researcher, it can be beneficial for their professional development and, in particular, it can help them to engage in creating new pedagogical designs.

Creating a new pedagogical design requires from student teachers to anticipate their actions, consider how their roles are changing depending on the setting and tasks, to reflect on the cross-curricular competencies required in the governmental curriculum, to evaluate the pedagogical relationship and to decide how it can help to introduce creative teaching, new tools, etc. PIO combines research methodology, innovative teaching, and professional procedures based on anticipation of what will happen in natural and complex environments. The innovative aspect is supported by the process of confrontation between predictions and observations in PIO, and by the instruction to student teachers to prepare a pedagogical design including a creative task in a small group setting.

In this teacher education course, student teachers had to develop pedagogical designs with the PIO method. The PIO method uses an iterative research methodology: the school practice is filmed and analyzed a first time in order to improve the pedagogical design for a subsequent trial, and

so on⁴. This iterative process allows student teachers to gradually consolidate their skills by alternating a researcher and practitioner standpoint. Before each trial, student teachers had to imagine the implementation of the pedagogical design in a real school environment and make predictions about how the design would run in practice, for instance attempting to predict the reactions of their pupils. These predictions were written and later compared to the result of the observations and analysis made on the recorded practice.

The PIO method was used in this course to provide student teachers with a specific procedure to scaffold the task of creating a new pedagogical design. In this sense, the PIO method targets four main objectives:

- To provide teachers students with opportunities to create an innovative pedagogical design while in pre-service education, and collaborate in its making; to elaborate and improve a pedagogical design focused on pupils’ creativity or creative thinking;
- To lead student teachers to confront their own predictions about the pedagogical design, with the observations made on the effective teaching they conducted ;
- To contribute to scientific research investigating teaching-learning processes in creative learning settings.

The use of PIO method for the elaboration and improvement of pedagogical designs is documented in a few studies (Giglio & Perret-Clermont, 2009, 2012), the results of which we briefly present in the next paragraph.

Firstly, teachers consider it possible to focus their teaching on a creative task for pupils, yet they recognize it is complex and sometimes requires re-organizing the classroom. Secondly, some teach-

⁴ This procedure has some elements in common with the *design experiment* methodology (Brown, 1992), yet here the iterative process is not used to discuss research hypotheses but rather to improve the teaching design.

ers stress the difficulty in welcoming the unexpected and to be led by the students' creative processes. Some teachers admit to not being able to refrain from making or creating instead of their pupils. Thirdly, teachers are in general positively surprised that pupils did not encounter the difficulties they expected with certain tasks.

A few guidelines to foster creative pedagogical designs in teacher education

The pedagogical designs made by student teachers during these two examples of practice in teacher education can constitute an interesting way to initiate innovative forms of teaching in primary or secondary schools. Simultaneously making such pedagogical designs may be considered an innovative form of teacher education. Yet, there are only two examples among many other possibilities which leads us to raise an important question: What is fostering creativity in the two examples proposed earlier in the paper? The next section tries to contribute to answer this question with a few comments.

We have presented two proposals for teacher education, both focusing on the same creative task, which is to elaborate pedagogical designs based on new teaching ideas aiming at innovative teaching practice. The pedagogical designs elaborated by student teachers in these cases are also expected to focus on a creative task for pupils, at any grade. We will now put an emphasis on two specific features which seem to us particularly important for fostering creativity, agency and learning, namely:

1. the process of anticipation;
2. the articulation of collective and solitary moments of work during the creative activity, resulting from the tasks planned in the design.

Innovating by anticipation, prediction and observation

In both teacher education examples of practice, the psychological process of *anticipating* a teaching practice by creating a pedagogical design plays an important role for student teachers to engage into a creative process. The procedure supporting the design is both similar and different in the two cases. Yet, both PIO and the adapted *didactic engineering* require from students to anticipate the practice involved in their own pedagogical design. While PIO requires precise predictions and research data to confront the predictions with observations, the adapted *didactic engineering* used in the first example focuses on the justification of the engineering choices, based on the analysis of the particular school context, the knowledge-to-be-taught, the tasks, social setting, etc. There is nevertheless also a process of anticipating the teaching practice, and a confrontation to observations, although these are mainly based on the experience of the lesson and on the participants' feedback and production during the lesson, rather than on video recorded data as in PIO.

More specifically to PIO is the iterative process of confronting predictions and observations, which is considered by Giglio and Perret-Clermont (2012) as motivating changes in the teaching practice at three different levels:

- At level 1, because it changes the interactions between the teacher and pupils during the class;
- At level 2, because it changes the interaction between the university of teacher education where a pedagogical design is elaborated, predicted and observed, and the school in which student teachers are putting the pedagogical design into practice;
- At level 3, because it changes the representation of the interaction between research and practice, notably in the way student teachers can take an intermediate position

between the position of practitioner, of designer and the position of researcher.

Articulating collective and solitary moments

An important question for teachers when designing a lesson is the following: How to foster interactions between teacher and pupils and between pupils? In order to define a panel of social situations, “collective moments” can be distinguished from “solitary moments”, the latter referring to situations where interactions between individuals are reduced to a minimum during an activity (Boissonnade, 2011). There are social and individual psychological processes both in collective and solitary moments. Hence, it is useful to make a clear distinction between the social setting (collective and solitary moments) and the unit of analysis adopted by the researcher (social or individual). This distinction enables us to distinguish solitary and collective moments in a pedagogical design in a similar way to pre-/post-test experimental paradigm, such as the one used for the socio-cognitive conflict theory (Perret-Clermont, 1980). For instance, pre-/post-test experimental design often set an initial and a final solitary moment, with diverse collective moments inbetween. Solitary moments are situated at one side of an interactional continuum, stretching from less interactive moments to more interactive moments. Solitary moments of work should be distinguished from *self-regulation*, which is also an important process during collective moments, as we can observe in group work intertwined mutual regulations and self-regulations.

This distinction between solitary and collective moments can also help to better comprehend teachers’ perspective and field experience. Indeed, teachers often hesitate to set group work, mentioning various difficulties like time constraints, difficulties to manage peer interactions in groups of pupils, or the lack of relevant activities (Gillies & Boyle, 2010). Moreover, even in good conditions for coop-

erative or collaborative interactions, several studies point out poor learning gains, for instance when pupils have no opportunity to discover the tasks individually and to explore it with their individual competencies and knowledge (e.g. Murphy & Messer, 2000) or when certain social regulations and influences occur, like overconfidence or imitation (e.g. Levin & Druyan, 1993; Puncocar & Fox, 2004).

In the first example of teacher education practice, the main phases are thought to imply interactions between a teacher educator and student teachers. Hence, the preliminary phase should help students to define the problem and understand the educator’s intent, but also to regulate common understanding and appropriation of ideas. It is also the case in the second phase, which is more collaborative. Indeed role-playing activity is precisely a collaborative task that cannot be done solitary. It is then not just hoping to entice socio-cognitive dynamics among pupils, but directly implying peer interactions from the task assignment. At a higher level, these collaborative interactions enhance participation and involvement of students in a trial to re-define the teacher’s role as genuine and innovative rather than normative and reproductive. Social interactions create the potential for deep changes in the individual representations. In this sense, collaboration can also be considered of educational value, i.e. as a directing force organizing the inter-individual actions and interactions in situation, opening possibilities for the students to think about their future profession as collaborative creation rather than as isolated pedagogical action.

In the second pedagogical design, several interactional levels are implemented including teachers and pupils, but also researchers and students. The interactions are thought to provoke a creative effort and commitment of student teachers in order to develop their own creative pedagogical design with pupils. The predictions and observations of a pedagogical design could be realized by one student as well as a small group or a whole classroom:

here, collaboration is not defining a kind of activity. But it is important to remember that predicting is not a purely rational activity, made of logical operations. It is a complex activity based also on perceptions, intuitions, feelings, imagination, combination and differentiation of past experiences, all of which are difficult to focus and share in a common discussion. Hence, it can be important to plan variations in the social setting of this task, and distinguish moments where student teachers make their own predictions separately, and moments where they predict in groups. The psychological means could be diverse, relatively to the actual social situation. In a rather different field (physics education), Boissonnade (2011) observed that a combination of moments, first “solitary”, second “dyadic”, and third “solitary” again, was a more efficient sequence to support predictions of 10 y. o. children. Concerning the second example of teacher education practice, we propose to develop it with a sequence alternating solitary with collective moments of work.

A proposal for further research

The distinction between collective and solitary moments in a pedagogical design motivates a more detailed analysis of the so-called *social interactions*. Indeed, social interactions are, at a finer level of analysis, made of micro-moments of joined attention and actions, interposed with micro-moments of self-driven attention and individual actions (short intervals where interactions are suspended, where each student thinks on their own, echoing the previous words, anticipating the next interactions or actions, and connecting themselves with their own past experiences and feelings, defining their personal positions about the problem, maybe writing notes on a sheet of paper in order to focus on and re-en-

gage a joined attention to the discourse or activity). On the other hand, some solitary moments are socially oriented: The prediction of the pupils’ behaviour in response to a pedagogical design includes the anticipation of social interactions and draws on previous collective moments of work. Hence, what could be considered frontal teaching and non-interactive, because the teacher is the only one actually producing a discourse, may also be considered a collaborative activity as regard to the social processes (interpreting sentences, imagining the educator’s intentions,...) that are concomitant to the individual processes (attention, memorizing, ...), and as regard to the co-regulation of the co-construction of mutual understanding by the whole class.

This discussion illustrates a potential new area for research, investigating the use and combination of solitary and collective moments in pedagogical design and practice. Moments of solitary activity can be planned to foster the appropriation of a *thinking space*, to improve a pedagogical design or to choose a personal stance on the problem in the current temporal and material constraints, while the interposed collective moments provide a social meaning, a shared orientation of the activity, and useful feedback to reflect on the personal appropriation and stance. The articulation of these various moments can be the focus of further research, investigating how specific pedagogical designs support pupils’ creativity and agency at the level of *micro-design*.

Future research could investigate the potential support to creativity offered by the various combinations of collective and solitary moments of activity. These combinations can be designed for the teaching practice to fit specific pedagogical and learning objectives, and can be evaluated through micro-design research.

References

- Amabile, T. M. (1993/1996). *Creativity in Context*. Boulder: Westview Press.
- Artigue, M. (1990). Ingénierie didactique. *Recherches en Didactique des Mathématiques*, 9, 281-308.
- Berman, L. M., Hultgren, F. H., Lee, D., Rivkin, M. S., & Roderick, J. A. (1991). *Toward curriculum for being*. Albany, NY: State University of New York Press.
- Boissonnade, R. (2011). *Apprendre et raisonner: approche développementale et socio-cognitive du rôle des situations collectives et individuelles d'apprentissage*. Thèse de doctorat, Université de Neuchâtel Faculté des Lettres et Sciences Humaines & Université de Toulouse.
- Brousseau, G. (1998/2004). *Théorie des situations didactiques*. Grenoble: La Pensée Sauvage.
- Brown, A. L. (1992). Design Experiment: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. *The Journal of the Learning Sciences*, 2, 141-178.
- Cros, F. (1996). Définitions et fonctions de l'innovation pédagogique. Le cas de la France de 1060 à 1994. In M. Bonami & M. Garant (Eds.), *Systèmes scolaires et pilotage de l'innovation. Émergence et implantation du changement* (pp. 15-31). Bruxelles: De Boeck.
- Damsa, C.-I., & Ludvigsen, S. R. (2011). Learning through collaborative creation of knowledge objects in teacher education. *International Conference of Computer-supported Collaborative Learning* (July).
- Doise, W., & Mugny, G. (1981). *Le développement social de l'intelligence*. Paris: Interéditions.
- Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- Engeström, Y., Riettinger, R., & Punamäki, R.-L. (Eds.) (1999). *Perspectives on activity theory*. Cambridge: Cambridge University Press.
- Gardner, H. (2001). *La inteligencia reformulada: las inteligencias múltiples en el siglo XXI*. Barcelona: Paidós.
- Giglio, M. (2014). Five dimensions to study teacher education change for improving musical creative learning. *Journal for Educators, Teachers & Trainers*, 5(1), 80-89.
- Giglio, M. (2015). *Creative Collaboration in Teaching*. Basingstoke, New York, NY: Palgrave MacMillan.
- Giglio, M., & Perret-Clermont, A.-N. (2009). L'acte créatif au cœur de l'apprentissage. *Enjeux pédagogiques*, 13, 16-17.
- Giglio, M., & Perret-Clermont, A.-N. (2010). A teaching sequence granting space to the students' collaborative creation in the music classroom: Some observations. In G. Mota & A. Yin (Eds.), *Proceeding of the 23rd International Seminar on Research in Music Education* (pp. 96-101). Changchun: North East Normal University.
- Giglio, M., & Perret-Clermont, A.-N. (2012). Prédire, agir, observer. Une méthodologie pour développer séquences pédagogiques et savoirs professionnels. *Pratiques de recherche dans les institutions de formation des enseignant-e-s*, 14, 127-140.
- Giglio, M., Matthey, M.-P., & Melfi, G. (2014). *Réactions des formateurs d'enseignants à un nouveau curriculum scolaire*. Bienne: Ed. HEP-BEJUNE.
- Gillies, R., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation. *Teaching & Teacher Education*, 26(4), 933-940.

- Grossen, M. (1988). *L'intersubjectivité en situation de test*. Cousset: Delval.
- Grossen, M. (1999). Approche dialogique des processus de transmission-acquisition de savoirs. Une brève introduction. *Actualités psychologiques*, 7, 1-32.
- John-Steiner, V. P., Connery, M. C., & Marjanovic-Shane, A. (2010). Dancing with the Muses: An Cultural-historical Approach To Play, Meaning Making and Creativity. In M. A. Connery, V. P. John-Steiner, & A. Marjanovic-Shane (Eds.), *Vygotsky and Creativity. A Cultural-historical Approach to Play, Meaning Making, and the Arts* (pp. 3-15). New York, NY: Lang.
- Kohler, A., Chabloz, B., & Perret-Clermont, A.-N. (2015). Dispositifs d'enseignement mi-finis: une condition de collaboration entre enseignants et chercheurs? *Cahiers de psychologie et éducation (Université de Neuchâtel)*, 51, 5-26.
- Leitão, S. (2000). The potential of argument in knowledge building. *Human Development*, 43, 332-360.
- Levin, I., & Druyan, S. (1993). When socio-cognitive transaction among peers fails: The case of misconceptions in science. *Child Development*, 64, 1571-1591.
- Littleton, K., & Howe, C. (2010). *Educational dialogues: Understanding and promoting productive interaction*. London: Routledge.
- Mayer, R. E. (1999). Fifty years of creativity research. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 449-460). Cambridge: Cambridge University Press.
- Mehmeti, T., & Perret-Clermont, A.-N. (2015). Seeking success of migrant students through designed tasks: A case study with Albanian students in Switzerland. In *Proceeding of the EARLI 2014 Meeting of the SIG 26 "Dialogue, Argumentation, and Reasoning"*.
- Miell, D., & Littleton, K. (2008). Musical collaboration outside school: Processes of negotiation in band rehearsals. *International Journal of Educational Research*, 47(1), 41-49.
- Moran, S., & John-Steiner, V. (2004). How collaboration in creative work impacts identity and motivation. In D. Miell & K. Littleton (Eds.), *Collaborative Creativity: Contemporary perspectives* (pp. 11-25). London: Free Association Books.
- Muller Mirza, N., & Perret-Clermont, A.-N., (2009). *Argumentation and Education: Theoretical Foundation and Practices*. New York, NY: Springer.
- Murphy, N., & Messer, D. (2000). Differential benefits from scaffolding and children working alone. *Educational Psychology*, 20, (1), 17-31.
- Osborne, J., Erduran, S., Simon, S., & Monk, M. (2001). Enhancing the quality of argument in school science. *School Science Review*, 82, 63-70.
- Perrenoud, P. (1994). *Métier d'élève et sens du travail scolaire*. Paris: ESF.
- Perret-Clermont, A.-N. (1980). *Social interaction and cognitive development in children*. New York, NY: Academic Press.
- Perret-Clermont, A.-N. (1991). La interacción social como espacio de pensamiento. *Anthropos: Boletín de información y documentación*, 124, 45-47.
- Perret-Clermont, A.-N. (2001). Psychologie sociale de la construction de l'espace de pensée. In J. Ducret (Ed.), *Actes du colloque. Constructivisme: usages et perspectives en éducation* (pp.65-82). Geneva: Département de l'Instruction Publique, Service de la recherche en Education.

- Perret-Clermont, A.-N., Brun, J., Conne, F., & Schubauer-Leoni, M.-L. (1982). Décontextualisation et recontextualisation du savoir dans l'enseignement des mathématiques à de jeunes élèves. *Interactions didactiques, 1*, 1-33.
- Perret-Clermont, A.-N., Carugati, F., & Oates, J. (2004). A socio-cognitive perspective on learning and cognitive development. In J. Oates & A. Grayson (Eds.), *Cognitive and language development in children* (pp. 305-332). Oxford: Blackwell.
- Psaltis, C., Gillespie, A., & Perret-Clermont, A.-N. (Eds.) (2015). *Social Relations in Human and Societal Development*. London: Palgrave MacMillan.
- Puncochar, J. M., & Fox, P. W. (2004). Confidence in individual and group decision making: When “two heads” are worse than one. *Journal of Educational Psychology, 96*, 582-591.
- Rogers, E. M., & Shoemaker, F. F. (1971). *Communication of Innovations: A Cross-Cultural Approach*. New York, NY: Free Press.
- Sawyer, R. K. (2008). Learning music from collaboration. *International Journal of Educational Research, 47*(1), 50-59.
- Schwarz, B. B., Neuman, Y., Gil, J., & Ilya, M. (2003). Construction of collective and individual knowledge in argumentative activity. *The Journal of the Learning Sciences, 12*, 219-256.
- Schwarz, B. B., Perret-Clermont, A.-N., Trognon, A., & Marro Clément, P. (2008). Emergent learning in successive activities: Learning in interaction in a laboratory context. *Pragmatics and Cognition, 16*(1), 57-91.
- Simonton, D. K. (1997). Products, persons, and periods: Histotimetric analyses of compositional creativity. In D. Hargreaves & A. North (Eds.), *The social psychology of music* (pp. 107-122). Oxford: Oxford University Press.
- Tiberghien, A. (1997). Learning and teaching: Differentiation and relation. *Research in Science Education, 27*, 359-382.
- Vygotsky, L. S. (1925/1971). *The psychology of art*. Cambridge, MA: The MIT Press.
- Vygotsky, L. S. (1930/2004). Imagination and creativity in childhood. *Journal of Russian and East European Psychology, 42*(1), 7-97.
- Vygotsky, L. S. (1931/1994). Imagination and creativity of the adolescent. In R. Van Der Veer & J. Valsiner (Eds.), *The Vygotsky Reader* (pp. 266-288). Cambridge-Oxford: Blackwell.

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Од иновативног образовања наставника до креативних педагошких пројеката

Скорашње образовне промене у различитим земљама су повезале педагошке иновације са крос-курикуларним компетенцијама, као што су социјалне и комуникативне вештине, метакогнитивне вештине, резонување и креативно размишљање. Ове компетенције су ретко главни фокус поучавања у школи, што нас наводи да узмемо у обзир сваку врсту поучавања које се сматра „иновативним“. Заправо, „иновација“ може да се дефинише као нове идеје, производи или пракса појединца или групе у оквиру посебног социјалног система (Rogers & Shoemaker, 1971). Међу различитим крос-курикуларним компетенцијама, у овом раду ћемо се усредсредити на „креативно мишљење“ или на „размишљање“. Усредсређивање на педагошке пројекте у вези са креативношћу очигледно није довољно да би се иновације увеле у процес поучавања. У току извођења планираних активности наставници и ученици могу да забораве, занемаре или погрешно протумаче намеру са којом се води пројекат. образовање наставника је домен праксе где постоји потреба да се успостави дијалог између професионалне традиције и иновације. Да би се допринело успостављању овог дијалога, у овом раду су представљена два примера праксе образовања наставника да би се направио простор и подлога за ученике и наставнике да развијају иновативне педагошке пројекте, засноване на креативности. Педагошки пројекти које су развили ученици и наставници могу заузврат да понуде ученицима могућност за посредовање, сарадњу и креативност.

Први часови праксе учитеља састојали се из израде „педагошког пројекта који нуди простор за размишљање“ (Mehmeti & Perret-Clermont, 2015). Требало је да студенти, будући наставници, осмисли час кроз активност игре улога са другим студентима и професором тако да сви имају улоге школског или факултетског ученика (студента). Игра улога подржана је специјално направљеним избором две ученичке стратегије, дефинисане листом карактера, а које супротстављају педагошки пројекат различитим класичним стратегијама, наводећи студенте да се искључе из активности. После практичног рада, студенти, односно будући наставници, добијали су повратну информацију о педагошком пројекту, базираном на искуству учесника као ученика, и на њихов предлог, критике и коментаре као наставника и едукатора наставника.

На другом практичном делу коришћена је методологија истраживања „PIO: Predicting, Implementing and Observing“ – „Предвиђање, имплементација и опсервација“ (Giglio & Perret-Clermont, 2012; Giglio, 2015). Студенти, будући наставници, морали су да развију педагошки пројекат према истраживачкој методологији, предвиђајући како ће у пракси да се одвија пројекат, уграђујући га у реално школско окружење и снимајући податке за анализу, као што су видео-записи одржаног часа. Анализа је сачињена ради побољшања педагошког пројекта за испитивање које следи. Овај процес понављања

је омогућавао студентима, будућим наставницима, да постепено консолидују своје вештине бивајући наизменично и истраживачи и практичари.

Шта смо научили из ова два примера? Можемо ли да формулишемо смернице које ће покренути креативне педагошке пројекте у образовању наставника? У оба случаја праксе, психолошки процес прихватања поучавања, док се осмишљава игра, има веома битну улогу и за покретање креативног размишљања и посредовања и приликом побољшавања педагошких пројеката. Приликом дискутовања о ова два предлога о образовању наставника, такође наглашавамо посебне „колективне“ и „самосталне“ моменте. На пример, у првом делу, самостални задатак се састоји од прихватања окружења у учионици и подржава га колективна игра по улогама. У другом делу, самостални momenti предвиђања ученичке реакције на пројекат су касније били супротстављени колективној дискусији у вези са пројектом. „Колективни“ и „самостални momenti“ могу да се прихвате као елементи микродизајна, којима могу да се направе различите комбинације како би се подржала креативност и посредовање ученика, то јест ефикасност која може да се процени током даљих истраживања.

Кључне речи: креативно мишљење, колективни момент, самостални момент.

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Promoting learning and development of students through argumentative interactions. A study of the teacher's questions in the learning contexts of higher education

Abstract: *This study sets out to investigate how learning and development of students through social interaction in the classroom can be pursued by the teacher in the learning contexts of higher education. The aim of this study is to compare the types of teachers' questions to their students used at undergraduate and graduate levels during argumentative disciplinary discussions in the classroom. The data corpus is constituted by 16 video-recorded lessons of two courses – one at undergraduate level and one at graduate level – in Developmental Psychology. The two courses were selected according to the following criteria: i) similar number of students, ii) similar disciplinary domain, iii) both courses are taught by the same teacher in English language. The analytical approach adopted for the analysis relies on a qualitative methodology based on the pragma-dialectical ideal model of a critical discussion. The findings of this study indicate that at the undergraduate level the teacher asks questions that can favour a large discussion with and among students around general topics relating to Developmental Psychology. At the graduate level the teacher asks questions that refer to specific aspects of a certain theory. However, both at undergraduate and graduate level the students are expected to provide the reasons at the basis of their own opinions by advancing arguments that have to refer to scientific theories. The results of this study bring to light the crucial role played by the teacher in promoting learning and development of students, by favouring the beginning of argumentative discussions with and among them on topics relating to the discipline taught in the course.*

Key words: *Argumentation; Higher Education; Qualitative Research; Student-Teacher Interaction; Teacher's Questions.*

Introduction

A clear goal of the actual reform movement in science education in EU is to encourage the growth of the argumentative skills of students

through teaching practices that foster and facilitate argumentative discussions in the classroom.

Since argumentation and discourse are central to the work of scientists, their role in science teacher education is relevant since teachers need to emulate and facilitate both in their class-

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rooms. In addition, both contribute to a pedagogically relevant socio-cultural framework for learning and can precipitate the active constructivism which can help students take ownership over their learning. (Eurydice¹, 2011, p.105)

In line with this new, strong focus within educational policy, the research on argumentation in science education has been intensified considerably, attracting growing attention “as a linguistic, logical, dialogical, and psychological process that sustains or provokes reasoning and learning” (Muller Mirza & Perret-Clermont, 2009, p.1). From primary school to the academic context, students encounter issues and positions that need to be developed, defended or evaluated (Buty & Plantin, 2008; Erduran & Jiménez-Aleixandre, 2007; López-Facal et al., 2015; Schwarz, 2009). Argumentation enables students to engage in knowledge construction, shifting the focus from rote memorization of notions and theories to a complex scientific practice in which they construct and justify knowledge claims (Kelly & Chen, 1999; Sandoval & Reiser, 2004). However, in contrast to argumentation in informal settings such as family meal-times (Bova & Arcidiacono 2014, 2015), argumentation in the learning contexts rarely occurs spontaneously. The argumentative disciplinary discussions in the classroom are to be explicitly promoted through teaching strategies that support student-to-student and student-to-teacher interactions (Hogan & Maglianti, 2001; Simon et al., 2006; Zohar & Nemet, 2002). Accordingly, the role of the teacher is crucial to foster students’ engagement in argumentation.

The present study intends to provide a further contribution to the recent literature on argumentation in the learning contexts of higher education. It specifically centers on the teacher’s questions to their students during argumentative disciplinary discussions in the classroom, i.e., task-related discussions concerning the discipline taught in the course. In line with other scholars (Kuhn, 1991; Voss & van Dyke, 2001), I refer to an individual argument as a product and to the argumentative discussion as a process, the latter being implicit in the

former. That being said, it is not a goal of the present study to make an assessment of the argumentative discussions occurring in the classroom between students and teacher, i.e. deciding whether or not the arguments advanced respect logical criteria. Rather, the goal is to compare the types of questions asked by the teacher to undergraduate and graduate students during argumentative disciplinary discussions in the classroom.

The data corpus on which the present study is based is composed of sixteen video-recorded separate lessons of one Bachelor’s degree and one Master’s degree course. In order to focus on the teacher’s questions, the object of investigation will be the argumentative discussions between students and teacher, as well as among students, occurring during their ordinary lessons, rather than an ad hoc setting created to favor the beginning of argumentative discussions. The analytical approach for the identification of the argumentative discussions is the pragmatodialectical ideal model of a critical discussion (van Eemeren & Grootendorst, 2004). This model proposes an ideal definition of argumentation developed according to the standard of reasonableness: an argumentative discussion starts when the speaker advances his/her standpoint, and the listener casts doubts upon it, or directly attacks the standpoint. Accordingly, confrontation, in which disagreement regarding a certain standpoint is externalized in a discursive exchange or anticipated by the speaker, is a necessary condition for an argumentative discussion to occur. This model particularly fits this study, and more generally, the study of argumentative interactions occurring in ordinary contexts, because it provides specific criteria in order to select and identify the argumentative discussions.

The present paper is structured as follows: in Section 2, a concise review of the most relevant literature on argumentation in learning contexts of higher education will be presented. In Section 3, the methodology on which the present study is based will be described. The results of the analysis are dis-

cussed in Section 4, followed by the Section 5, which summarizes the main findings and comments on their limitations and strengths.

Argumentation studies in learning contexts of higher education

Over recent years, several studies have been devoted to examine the conditions which can favor or disfavor the creation of effective argumentative activities at a primary and middle school level (Baker, 2002; Duschl & Osborne, 2002; Jiménez-Aleixandre, 2007; Sadler, 2006), to establish which criteria must be included in assessing the argumentative skills of pupils and students (Anderson et al., 1997; Garcia-Mila & Andersen, 2007; Muller Mirza et al., 2009), and how to further improve these skills (Kuhn & Udell, 2003; Nussbaum & Schraw, 2007; Schwarz & Linchevski, 2007; Zohar & Nemet, 2002). Despite fewer in number, the works focused on the learning contexts of higher education too have brought to light relevant insights in the fields of education and argumentation theory.

Overall, the results of these studies indicate that in the learning contexts of higher education the role of the teacher is essential for engaging students in argumentation (McNeill & Krajcik, 2009), by favoring argumentative debates in the classroom and enhancing students' motivation (Chin & Osborne, 2010), and helping them detect and resolve errors (Schwarz et al., 2000). A series of other studies have shown that engagement in constructing arguments enhances students' knowledge by promoting conceptual change (e.g., Nussbaum & Sinatra, 2003; Wiley & Voss, 1999), and that the engagement in argumentative small- or large-group discussions improves conceptual understanding (e.g., Alexopoulos & Driver, 1996; Andrews, 2009; Mason, 2001). The role of argumentation in the academic context is also currently stressed by a growing literature that emphasizes the problem of constructing students' knowledge taking into account their level of

knowledge of the topic under consideration (Driver et al., 2000; Jiménez-Aleixandre et al., 2000; Kelly & Takao, 2002; Macagno & Konstantinidou, 2013; Osborne, 2005; Sampson & Clark, 2008). In this regard, it has been documented that previous knowledge in the domain is a significant predictor of comprehension of the arguments advanced within a scientific text (e.g., Alexander et al., 1994; Means & Voss, 1996).

The two major points highlighted by the previous studies on argumentation in the learning contexts of higher education, i.e., the crucial role played by the teacher for engaging students in argumentation and the importance of taking into account the students' level of knowledge of the discipline taught in the course, lead us to focus on two fundamental questions from an educational and learning perspective: (i) "How do the teachers promote and manage argumentation with and among students in classes of different levels?" And (ii) "Do they adapt their teaching style to their students' level of knowledge of the discipline taught in the course?" In order to answer these questions, the present study focuses on the teacher's questions to their students during argumentative disciplinary discussions in the classroom, i.e., task-related discussions concerning the discipline taught in the course, with the aim to compare the types of questions asked at undergraduate level and at graduate level.

The choice to center the present investigation on the teacher's questions to the students stems from the crucial role played by questions in triggering argumentative discussions, as amply demonstrated in the literature on argumentation in different spheres of activities. For example, in a study on the argumentative practices in the family context, Bova and Arcidiacono (2013) have shown that the why-questions asked by children to their parents have not only an explanatory function, i.e., asking for an explanation of the reasons at the basis of a fact or event, but also an argumentative function. According to the authors, this type of question challenges parents to

justify their rules and prescriptions, which remain frequently implicit or based on rules not initially known by or previously made explicit to children. Similar results were also found by Chouinard et al. (2007) and Frazier et al. (2009). In a similar vein, Chin and Osborne (2010), in a study focused on the verbal interactions among students aged 12-14 years during group discussions concerning scientific topics, showed that the most significant contributions of students' questions is their potential in scaffolding students' argument construction by eliciting the epistemic features of explanations with requests for "data", "evidence", and "counter-arguments". According to these authors, students' questions serve as triggers to enable argumentative and epistemic moves, such as concessions, challenges and counter-challenges, which subsequently led to the construction of more elaborate explanations and justifications, as well as to changes in the standpoints of members who modified their initial conceptions.

Thus far, the attention of educationists and psychologists has been mainly devoted to investigate the questions asked by children and students. Shifting the focus from students' questions to teacher's questions during argumentative disciplinary discussions in the classroom, the present study intends to provide a further contribution to the recent literature on argumentation in the learning contexts of higher education. In the next sections of the paper I will present the research design, as well as the main results of the study.

Methodology

Data Corpus

The data corpus is composed of sixteen video-recorded separate lessons (constituting about 24 hours of video data) of one Bachelor's degree (sub-corpus 1) and one Master's degree course (sub-corpus 2). The length of each recording varies from 84 to 98 minutes. The two courses have been selected according to the following criteria: i) similar num-

ber of students (about 15 students); ii) similar disciplinary domain (both courses considered handle are in the area of developmental psychology); iii) both courses are taught by the same teacher in English language.

Sub-corpus 1 consists of 8 video-recorded lessons of the third year elective course "Adolescent Development: Research, Policy, and Practice" of the Bachelor's degree at the University College of Utrecht (UCU). The sub-corpus 1 is constituted by 14 students, 4 boys and 10 girls. All the students at the time of data collection were in their early 20s ($M = 21.80$; $SD = 1.80$). There was no significance difference of age between boys ($M = 21.89$; $SD = 2.66$) and girls ($M = 21.74$; $SD = 1.20$).

Sub-corpus 2 consists of 8 video-recorded lessons of the first year elective course "Human development and developmental psychopathology" of the Master's degree program Development and Socialization in Childhood and Adolescence (DASCA) at the Utrecht University (UU). The sub-corpus 2 is constituted by 16 students, who were all girls. Most of the students at the time of data collection were in their early 20s ($M = 23.00$; $SD = 1.60$).

Students' level of knowledge of the discipline

Before starting the first lesson of the course (December 2013), both undergraduate and graduate students were asked by their teacher (i) to rate in a scale from 1 (none) to 9 (excellent) their own ability to communicate in English language, (ii) if they had already took an academic course in Developmental Psychology, and (iii) to rate in a scale from 1 (none) to 9 (excellent) the level of their previous knowledge in Developmental Psychology, i.e., before taking the course (see Appendix A). As for the ability to communicate in English language, in a scale from 1 to 9 the average score of the undergraduate students, according to their own perception, was $M = 8.28$, while the average score of the graduate students was slightly lower $M = 7.56$. The most part of the students did already take an academic course in Devel-

opmental Psychology, both undergraduate (Yes N= 12; No N= 2) and graduate level (Yes N= 15; No N= 1). As for the level of their previous knowledge of the discipline taught in the course, in a scale from 1 to 9 the average score of the undergraduate students, according to their own perception, was slightly lower (M = 6.35) than graduate students (M = 7.25).

Detailed information on the information obtained from the questionnaire are presented below, in Table 1:

	Bachelor	Master
Students' own perception of their ability to communicate in English - in a scale from 1 (none) to 9 (excellent)	8.28	7.56
Students who already took a course in Developmental Psychology	Yes N = 12 No N = 2	Yes N = 15 No N = 1
Students' own perception of their knowledge in Developmental Psychology before the beginning of the course - in a scale from 1 (none) to 9 (excellent)	6.35	7.25

Table 1. *Information obtained from the questionnaire administered to bachelor and master students*

Transcription Procedures and Ethical Issues

All lessons have been transcribed in their totality with the CHILDES standard transcription system (CHAT) (MacWhinney, 2000), with some modifications introduced to enhance readability (see Appendix), and revised by two researchers until a high level of consent (agreement rate = 90%) has been reached. All turns have been numbered progressively within the discussion sequence, and participants are identified by role for the teacher (e.g., TEACH) and by role, number, and gender for student (e.g., STU1M, STU2F, STU3F, etc.).

The ethical framework that guides this research includes informed consent from the partici-

pants, anonymity and confidentiality. All participants were approached by means of an information sheet outlining in clear language the general purpose of the study and providing information about how the video data would be used. Consent letters have been written in accordance with Dutch Association of Psychologists (NIP) and American Psychological Association (APA) guidelines, specifically, the format outlined in the fifth edition of the Publication Manual of the American Psychological Association (APA, 2009). In line with the ethical framework guiding the research, the students were assured that their anonymity would be maintained at all stages of the study. Transcriptions and video-recorded material have been treated in the strictest confidence and seen only by researchers.

Analytical Approach

The ideal model of a critical discussion

The analytical approach adopted for the analysis is the pragma-dialectical ideal model of a critical discussion (van Eemeren & Grootendorst, 2004). This approach considers that argumentative speech acts are not performed in a social vacuum, but between two or more parties who are having a disagreement and interact with each other in an attempt to resolve this disagreement. The pragma-dialectical ideal model of a critical discussion spells out four stages that are necessary for a dialectical resolution of differences of opinion between a protagonist that advances and sustains a standpoint and an antagonist that assesses it critically: at the *confrontation stage*, it is established that there is a dispute. A standpoint is advanced and questioned; at the *opening stage*, the decision is made to attempt to resolve the dispute by means of a regulated argumentative discussion. One party takes the role of protagonist, and the other party takes the role of antagonist; at the *argumentation stage*, the protagonist defends his/her standpoint and the antagonist elicits further argumentation from him/her if he/she has further doubts; at the *concluding stage*, it is established

whether the dispute has been resolved on account of the standpoint or the doubt concerning the standpoint having been retracted.

In the present study, the ideal model of a critical discussion is assumed as a grid for the analysis since it provides the criteria for the selection of the argumentative discussions.

Selection of argumentative discussions

For the present study, only the discussions that fulfill two of the following three criteria, one between *i.a* and *i.b* and always the *ii.*, have been considered as an argumentative discussion:

- i.a* at least one standpoint concerning an issue related to the discipline taught in the course put forth by one or more students is questioned – either by means of a clear disagreement or by means of a doubt – by the teacher or by (at least) one classmate.
- i.b* at least one standpoint concerning an issue related to the discipline taught in the course put forth by the teacher is questioned – either by means of a clear disagreement or by means of a doubt – by one or more students.
- ii.* at least one student advances at least one argument either in favor of or against the standpoint being questioned.

Identification of the types of questions

The argumentation data for each session were obtained by reviewing both the video recording and the corresponding transcript. For the scope of the

present study, all the questions asked by the teacher to their students during the argumentative disciplinary discussions in the classroom were selected (N= 272). Once identified, the questions asked by the teacher were distinguished according to the following criteria:

- the question refers to broad topics in the field of Developmental Psychology (hereafter, BROAD QUESTION), e.g. *What are the main reasons leading to episodes of bullying among adolescents?*
- the question refers to a specific theory or to a certain aspect of a theory in the field of Developmental Psychology (hereafter, SPECIFIC QUESTION), e.g. *Which developmental processes can be studied by each of the seven models described by Graber and Brooks-Gunn and how?*

Results

In the corpus, N= 94 argumentative discussions, N= 59 at graduate level and N= 35 at undergraduate level, were found. The total number of questions asked by the teacher to their students during the argumentative disciplinary discussions in the classroom was N= 272. The analysis of the questions asked by the teacher to their undergraduate students involved N= 35 argumentative discussions for a total number of N= 121 questions, while the analysis of the questions asked by the teacher to their graduate students involved N= 59 argumentative discussions for a total number of N= 161 questions (see Table 2).

	Bachelor	Master	TOTAL
Number of argumentative discussions	35	59	94
Arguments put forth by students	75	167	242
Average number of arguments advanced during an argumentative discussion	3.26	3.88	3.66
Teacher's questions to their students during the argumentative disciplinary discussions in the classroom	121	161	282
Average number of teacher's questions to their students during the argumentative disciplinary discussions in the classroom	3.45	2.72	2.89

Table 2. Contributions of students and teacher in argumentative discussions in the classroom

In order to present the results of this study, a selection of excerpts of talk-in-interaction representative of the results obtained from the larger set of analyses conducted on the whole corpus of teacher's questions will be presented.

Analysis of the teacher's questions

The findings show that in large part the teacher asked questions that can favor a large discussion with and among students around general topics relating to Developmental Psychology (BROAD QUESTIONS) to her undergraduate students (N= 87; 72%). The following excerpt presents a clear illustration of the use of this type of question by the teacher.

Excerpt 1

Lesson 3. Min. 38:12. Participants: teacher (TEACH), students (STU2F; STU14M).

1. *TEACH: **according to the cultural approach, all the values, what is right or what is wrong is cultural specific, they depends on culture [...] what do you think about this?**
2. *STU14M: **yes, is right. otherwise slavery wouldn't have been permitted**
3. *TEACH: **yes, good point**
4. *STU14M: **at a certain time at a certain place, it was possible**
5. *TEACH: **right**
6. %pau: 2.0 sec
7. *STU2F: **not everything, though**
8. *TEACH: **what?**
9. *STU2F: **not everything is acceptable. there is not a mother that would accept to kill her son. it is not culture it is the nature of human beings**

[...]

In this example we can observe how the teacher asked a BROAD QUESTION (line 1, in *Italic* in the excerpt: "what do you think about this?")

to her undergraduate students in order to favour the beginning of a discussions among them around a general topic related to Developmental Psychology, i.e., the cultural approach and its implications. With this question, the teacher favours a large discussion in the classroom since the students are not requested to have a detailed knowledge of the cultural approach to participate in this discussion. Not by chance, subsequently we can see that the students actually engage in an argumentative discussion. The student STU2F put forth an argument (line 9) to oppose another argument (line 2 and line 4) previously advanced by one of her classmate (STU14M).

In the corpus, the teacher asked only in few occasions SPECIFIC QUESTIONS to her undergraduate students (N= 34; 28%). These questions were typically asked by the teacher when the argumentative discussion was started and the students had already advanced their opposite standpoints. The goal of these questions was, in fact, not to favour the beginning of a new discussion among students but rather the continuation of a pre-existing discussion.

Similarly to what was observed with regard to the undergraduate students, the BROAD QUESTIONS (N= 65; 40%) were in most cases asked by the teacher to graduate students to favor the beginning of a new discussion among them. On the other hand, differently from what was observed for undergraduate students the findings indicate that more than half of the times the teacher asked SPECIFIC QUESTIONS to her graduate students (N= 96; 60%). The following excerpt presents a clear illustration of the use of this type of question by the teacher.

Excerpt 2

Lesson 6. Min. 32:15. Participants: teacher (TEACH), student (STU7F; STU14F).

1. *TEACH: **we talked about the risk of drug abuse, drinking, unprotected sex**

2. *STU7F: **it is a risky development phase**
 3. *STU14F: **sure, there are many risk behaviours in this phase ((adolescence))**
 4. *TEACH: ***what are the most important processes that according to Steinberg and Morris explain the fact that many risk behaviors tend to peak in adolescence?***
 5. *STU7F: **they say that most teens know plenty about the dangers of risk-taking behaviors like drinking, smoking, and taking drugs, but they ignore on purpose what they have learned**
 6. *STU14F: **this is not true, it is the influence of peers. Steinberg and Morris said that the presence of peers increased risk taking by 50% in adolescence**
 7. *TEACH: **why do their presence ((of peers)) increase risk taking in adolescence?**
 8. *STU14F: **when they are not around peers, adolescents are much better at controlling impulsive or risky behaviors**
- [...]

In example 2, the topic of the discussion between teacher and students is “risk behaviours in adolescence”. In line 3, (in *Italic* in the excerpt) the teacher asks a SPECIFIC QUESTION to her students related to one of the best-known grand theories of adolescent development, namely, the theory of adolescent development and psychological functioning proposed by Laurence Steinberg and Amanda S. Morris (Steinberg & Morris, 2001). In this case, the teacher’s question favours the beginning of an argumentative discussion initially between two students who clearly have to different opinions, STU7F and STU14F, and that will involve also other students afterwards. In line 7 the teacher asks a why-

question to her student (STU14F). With this question, the teacher is asking her student to advance arguments in support of the assertion she previously made in line 6. In line 8, the student replies to the teacher by advancing an argument in support of her previous assertion. This discussion on the effects of family relationships on the adolescent development will continue involving also other students afterwards.

Discussion

In order to provide a further contribution to the study of argumentative practices in the learning contexts, this study set out to investigate the teacher’s questions to their students during argumentative disciplinary discussions in the classroom, i.e., task-related argumentative discussions concerning the discipline taught in the course, with the aim to compare the types of questions used at undergraduate and graduate levels. The results of this study indicate that at the undergraduate level the teacher in most cases asks questions that can favor a large discussion with and among students, and they are not focused on limited, specific aspects of a theory. Rather, the teacher’s questions aim to favor a discussion around a more general topic related to the discipline taught in the course, i.e., Developmental Psychology (BROAD QUESTIONS). On the contrary, we have seen that at the graduate level the teacher in most cases asks questions that refer to specific aspects of a certain theory (SPECIFIC QUESTIONS).

Among the many reasons than can at different degrees explain the differences in the types of questions used by the teacher at undergraduate and graduate level, I will focus on one aspect that I think might contribute to clarify the reasons underlying these results. I refer to the actual knowledge by students of the discipline taught in the course, i.e., Developmental Psychology. Despite undergraduate and graduate students - according to their own perception - claim to have a similar knowledge in

Developmental Psychology (graduate students $M=7.25$ vs. graduate students $M=6.35$), in line with the results obtained by previous studies (e.g., Kelly & Takao, 2002; Means & Voss, 1996; Osborne, 2005) the observations of the topics treated during the lessons, of the student-teacher and student to student interactions suggest that the younger students had an actual knowledge of the discipline much lower than younger students, even more than what was claimed in the answers to the questionnaire. In most cases, in fact, the arguments used by the undergraduate students referred to a well-known theory, however avoiding to mention the correct term of the scientific notion they refer to. In the corpus, I observed that the knowledge in Developmental Psychology of the graduate students was more detailed compared to undergraduate students. For example, in the excerpt 2 we have seen that the graduate students were able to advance arguments that refer to well-specific aspects of a scientific theory, i.e., the theory of adolescent development by Steinberg and Morris, to support their own standpoints. Moreover, the graduate students were also able to engage in argumentative discussions relating to the different theories that treat limited aspects of a certain topic discussed during the lessons.

The creation by teacher of situations in which it makes sense for students to freely engage with one another's ideas is a clear-cut example of how students have a chance to learn from disciplinary argumentative discussions (e.g., important theories, laws, models, or concepts). How do these results relate to actual crucial questions involving learning and argumentation? From a learning perspective, the results of this study bring to light the crucial importance of a teachers' training aimed at making teachers aware of the role of questions in promoting effective argumentation among students. The learning benefit for students resides in being active participant in the argumentative process of construction of new knowledge, and not only listeners (Baker, 2009). The literature has already demonstrated that discussing about a certain topic is more effec-

tive than only listening it (e.g., Chin & Osborne, 2010; Nussbaum & Sinatra, 2003; Schwarz et al., 2000; Wiley & Voss, 1999). In agreement with other scholars (Ford, 2008; Kuhn, 1993; Newton et al., 1999), if students are not empowered to criticize the ideas being discussed then they must accept the ideas that sound plausible and/or are held by the individual with the most clout. From an argumentative perspective, this study shows how the contextualization of argumentation (van Eemeren, 2010, 2011) is fundamental in the study of school contexts. The use of argumentation theories and analytical models cannot consider the context as given: it is needed to focus the investigation on the interactions between teachers and students in the classroom in order to properly analyse the argumentative dynamics occurring in the classroom. In particular, the *argumentative roles* (see van Eemeren & Grootendorst, 2004, pp.59-62), e.g. protagonist/antagonist, played by the teacher and the students and the *interpersonal and institutional constraints* (van Eemeren, 2011) on the argumentative interactions in the classroom imposed by the school contexts are two aspects that certainly still need further detailed investigations.

Even though the present study provides new insights of the argumentative interactions between students and teacher in the learning contexts of higher education, I need to address several limitations. A first limitation involves the presence of a video camera in the classroom. Although it is possible that the presence of a video camera may have influenced student behavior, it is difficult to predict in which direction. Informal observation, however, suggested that students in both conditions were very attentive and were highly engaged as they worked. A second limitation involves the limited number of recordings that, on the one hand, have favored a more careful analysis but, on the other hand, did not allow certain quantifications such as the correlation between categories. A larger database would probably permit more quantitatively reliable data for certain statistical relationships. Using a natural setting does not automatically solve the problem of obtain-

ing optimal data. Nevertheless, the interactions between students and teacher in the learning contexts of higher education are an invaluable source for the

investigation of the argumentative dynamics in the classroom within an emic perspective.

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Notes

The Eurydice Network provides information on and analyses of European education systems and policies. As from 2013 it consists of 40 national units based in all 36 countries participating in the EU's Lifelong Learning programme. It is co-ordinated and managed by the EU Education, Audiovisual and Culture Executive Agency (EACEA) in Brussels, which drafts its studies and provides a range of online resources. For more information, see http://eacea.ec.europa.eu/education/eurydice/index_en.php

References

- Alexander, P. A., Kulikowich, J. M., & Schulze, S. K. (1994). The influence of topic knowledge, domain knowledge, and interest on the comprehension of scientific exposition. *Learning and Individual Differences*, 6(4), 379-397.
- Alexopoulou, E., & Driver, R. (1996). Small-group discussion in physics: Peer interaction modes in pairs and fours. *Journal of Research in Science Teaching*, 33(10), 1099-1114.
- Anderson, R. C., Chinn, C. A., Chang, J., Waggoner, M., & Yi, H. (1997). On the logical integrity of children's arguments. *Cognition and Instruction*, 15(2), 135-167.
- Andrews, R. (2009). A case study of argumentation at undergraduate level in History. *Argumentation. Special Issue on Argumentation and Education: Studies from England and Scandinavia*, 23(4), 547-548.
- APA. (2009). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: American Psychological Association.
- Baker, M. (2002). Argumentative interactions, discursive operations and learning to model in science. In P. Brna, M. Baker, K. Stenning, & A. Tiberghien (Eds.), *The role of communication in learning to model* (pp. 303-324). Mahwah, NJ: Lawrence Erlbaum.
- Bova, A., & Arcidiacono, F. (2013). Investigating children's Why-questions. A study comparing argumentative and explanatory function. *Discourse Studies*, 15(6): 713-734.
- Bova, A., & Arcidiacono, F. (2014). "You must eat the salad because it is nutritious". Argumentative strategies adopted by parents and children in food-related discussions at mealtimes. *Appetite*, 73, 81-94.
- Bova, A., & Arcidiacono, F. (2015). Beyond conflicts. Origin and types of issues leading to argumentative discussions during family mealtimes. *Journal of Language Aggression and Conflict*, 3(2).
- Buty, C., & Plantin, C. (2008). *Argumenter en classe de sciences. Du débat à l'apprentissage*. Lyon: INRP.
- Chin, C., & Osborne, J. (2010). Supporting argumentation through students' questions: Case studies in science classrooms. *Journal of the Learning Sciences*, 19(2), 230-284.

- Chouinard, M.M., Harris, P.L., & Maratsos, M.P. (2007). *Children's Questions: A Mechanism for Cognitive Development*. Boston, MA: Blackwell.
- Driver, R., P. Newton, & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312.
- Duschl, R., & Osborne, J. (2002). Supporting and promoting argumentation discourse in science education. *Studies in Science Education*, 38(1), 39-72.
- van Eemeren, F.H. (2010). *Strategic maneuvering in argumentative discourse*. Amsterdam: John Benjamins.
- van Eemeren, F.H. (2011). In context. Giving contextualization its rightful place in the study of argumentation. *Argumentation*, 25(2), 141-161.
- van Eemeren, F.H., & Grootendorst, R. (2004). *A systematic theory of argumentation: The pragma-dialectical approach*. Cambridge: Cambridge University Press.
- Erduran, S., & Jiménez-Aleixandre, M. P. (2007). *Argumentation in science education: Perspectives from classroom-based research*. Dordrecht: Springer.
- Eurydice. (2011). *Science education in Europe: National policies, practices and research*. Brussels: EACEA. doi: 10.2797/7170
- Ford, M. (2008). Disciplinary authority and accountability in scientific practice and learning. *Science Education*, 92(3), 404-423.
- Frazier, B.N., Gelman, S.A., & Wellman, H.M. (2009). Preschoolers' search for explanatory information within adult: Child conversation. *Child Development*, 80(6), 1592-1611.
- Garcia-Mila, M., & Andersen, C. (2007). Cognitive foundations of learning argumentation. In S. Erduran, & M. P. Jiménez-Aleixandre (Eds.), *Argumentation in science education: Perspectives from classroom-based research* (pp. 28-44). Dordrecht: Springer.
- Hogan, K., & Maglienti, M. (2001). Comparing the epistemological underpinnings of students and scientists reasoning about conclusions. *Journal of Research in Science Teaching*, 38(6), 663-687.
- Jiménez-Aleixandre, M. P. (2007). Designing argumentation learning environments. In S. Erduran, & M. P. Jiménez-Aleixandre (Eds.), *Argumentation in science education: Perspectives from classroom-based research* (pp. 89-113). Dordrecht: Springer.
- Jiménez-Aleixandre, M.P., Rodriguez, A.B., & Duschl, R.A. (2000). "Doing the lesson" or "Doing science": Argument in high school genetics. *Science Education*, 84(6), 757-792.
- Kelly, G. J., & Chen, C. (1999). The sound of music: Constructing science as sociocultural practices through oral and written discourse. *Journal of Research in Science Teaching*, 36(8), 883-915.
- Kelly, G., & Takao, A. (2002). Epistemic levels in argument: An analysis of university oceanography students' use of evidence in writing. *Science Education*, 86(3), 314-342.
- Kuhn, D. (1991). *The skills of argument*. New York, NY: Cambridge University Press.
- Kuhn, D. (1993). Science as argument: implications for teaching and learning scientific thinking. *Science Education*, 77(3), 319-337.
- Kuhn, D., & Udell, W. (2003). The development of argument skills. *Child Development*, 74(5), 1245-1260.

- López-Facal, R., Jiménez-Aleixandre, M. P., & Arcidiacono, F. (2015). Le territoire comme composante de l'identification nationale dans l'argumentation des élèves du secondaire. In N. Muller Mirza & C. Buty (Eds.), *Argumentation dans les contextes de l'éducation* (pp. 323-354). Bern: Lang.
- Macagno, F., & Konstantinidou, A. (2013). What students' arguments can tell us: Using argumentation schemes in science education. *Argumentation*, 27(3), 225-243.
- MacWhinney, B. (2000). *The child project: Computational tools for analyzing talk*. Pittsburgh, PA: Routledge.
- Mason, L. (2001). Introducing talk and writing for conceptual change: A classroom study. *Learning and Instruction*, 11(6), 305-329.
- McNeill, K. L., & Krajcik, J. (2009). Synergy between teacher practices and curricular scaffolds to support students in using domain specific and domain general knowledge in writing arguments to explain phenomena. *Journal of the Learning Sciences*, 18(3), 416-460.
- Means, M.L., & Voss, J.F. (1996). Who reason well? Two studies of informal reasoning among children of different grade, ability, and knowledge levels. *Cognition and Instruction*, 14(2), 139-178.
- Muller Mirza, N., & Perret-Clermont, A.-N. (Eds.) (2009). *Argumentation and education*. New York, NY: Springer.
- Muller Mirza, N., & Perret-Clermont, A.-N., Tartas, V., & Iannaccone, A. (2009). Psychosocial processes in argumentation. In N. Muller Mirza, & A.-N. Perret-Clermont (Eds.), *Argumentation and education* (pp. 67-90). New York, NY: Springer.
- Newton, P., Driver, R., & Osborne, J. (1999). The place of argument in the pedagogy of school science. *International Journal of Science Education*, 21(5), 553-576.
- Nussbaum, E. M., & Sinatra, G. M. (2003). Argument and conceptual engagement. *Contemporary Educational Psychology*, 28(3), 384-395.
- Nussbaum, E. M., & Schraw, G. (2007). Promoting argument-counterargument integration in students' writing. *The Journal of Experimental Education*, 76(1), 59-92.
- Osborne, J. (2005). The role of argument in science education. In K. Boersma, M. Goedhart, O. de Jong, & H. Eijkelhof (Eds.), *Research and the Quality of Science Education* (pp. 367-380). Dordrecht: Springer.
- Sadler, T. D. (2006). Promoting discourse and argumentation in science teacher education. *Journal of Science Teacher Education*, 17(4), 323-346.
- Sampson, V., & Clark, D. (2008). Assessment of the ways students generate arguments in science education: Current perspectives and recommendations for future directions. *Science Education*, 92(3), 447-472.
- Sandoval, W. A., & Reiser, B. J. (2004). Explanation-driven inquiry: Integrating conceptual and epistemic scaffolds for scientific inquiry. *Science Education*, 88(3), 345-372.
- Schwarz, B. B. (2009). Argumentation and learning. In N. Muller Mirza & A.-N. Perret-Clermont (Eds.), *Argumentation and education* (pp. 91-126). New York, NY: Springer.
- Schwarz, B. B., & Linchevski, L. (2007). The role of task design and argumentation in cognitive development during peer interaction: The case of proportional reasoning. *Learning and Instruction*, 17(5), 310-331.
- Schwarz, B. B., Neuman, Y., & Biezuner, S. (2000). Two wrongs may make a right...if they argue! *Cognition and Instruction*, 18(4), 461-494.

- Simon, S., Erduran, S., & Osborne, J. (2006). Learning to teach argumentation: Research and development in the science classroom. *International Journal of Science Education*, 28(2), 235-260.
- Steinberg L, & Morris A.S. (2001). Adolescent development. *Annual Review of Psychology*, 52, 83-110.
- Wiley, J., & Voss, J. F. (1999). Constructing arguments from multiple sources: Tasks that promote understanding and not just memory for text. *Journal of Educational Psychology*, 91(2), 301-311.
- Voss, J. F., & van Dyke, J. A. (2001). Argumentation in psychology: Background comments. *Discourse Processes*, 32(2-3), 89-111.
- Zohar, A., & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching*, 39(1), 35-62.

Appendix

Transcription conventions

*	indicates the speaker's turn
[...]	not-transcribed segment of talking
,	continuing intonation
.	falling intonation
:	prolonging of sounds
?	rising intonation
!	exclamatory intonation
%pau:	pause of 2.5 sec

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**Промовисање учења и развоја студената кроз аргументовану интеракцију
– студија питања наставника у контексту учења у оквиру високог образовања**

Аргументована дискусија омогућава студентима да се ангажују у конструсању знања, да помере фокус са рутинског меморисања чињеница и теорија на сложену научну праксу којом конструишу и оправдавају захтеве знања. Иначе, за разлику од аргументоване дискусије у неформалном окружењу, као што је окупљање породице за време оброка, аргументована дискусија у контексту учења се ретко одвија спонтано. Аргументоване дискусије које се тичу научних дисциплина у учионици, то јест дискусије које се односе на задатке на часу у вези са научном дисциплином треба да се експлицитно промовишу кроз стратегије учења које подржавају интеракцију између студената и интеракцију између студената и наставника. Сходно томе, улога наставника је главна у циљу подстицања учешћа студента у аргументованој дискусији.

Ова студија има за циљ да својим резултатима допринесе постојећој литератури која се тиче аргументоване дискусије у контексту учења у високом образовању. Она се посебно усредсређује на питања коју упућују наставници својим студентима у току аргументоване дискусије у вези са научним дисциплинама у разреду ради упоређивања свих питања која постављају наставници на основним и дипломским нивоима студирања. Корпус података се састоји од шеснаест снимљених часова два курса – једног на основним студијама, а другог на дипломским студијама, а тичу се развојне психологије. Два курса су изабрана према следећим критеријумима: 1) сличан број студената; 2) сличан домен научне дисциплине; 3) оба курса држи исти наставник на енглеском језику. Аналитички приступ идентификацији аргументоване дискусије је прагма-дијалектички идеал модела критичке дискусије. Овај модел представља идеалну дефиницију аргументације која се развила према логичном стандарду: аргументована дискусија почиње када говорник развија своје мишљење, а слушалац сумња или директно напада ставове говорника. Сходно томе, конфронтација, по којој се неслагање које се тиче одређене тачке гледишта развија у дискурзивној размени или коју говорник прихвата, јесте неопходан услов да се развија аргументована дискусија.

Резултати ове студије указују на чињеницу да, на нивоу основних студија, наставник у већини случајева поставља питања која доводе до широке дискусије међу студентима, а која нису усредсређена на ограничене, посебне аспекте теорије. Пре питања наставника имају за циљ да задрже дискусију око општијих питања која се тичу одређене научне дисциплине, као што је, на пример, развојна психологија (питања широког спектра). Напротив, на нивоу дипломских студија, наставник у већини случајева поставља питања која се односе на посебне аспекте одређене теорије (специфична питања). Главни разлог који може да допринесе објашњавању ових резултата је право знање студената у вези са научном дисциплином која се проучава на курсу, то јест са развојном психологијом. Опсервација тема које се обрађују током часова, а што се уочава у интеракцији, указује да су млађи студенти имали мање знања о теоријским дисциплинама које су се обрађивале. У већини случајева, аргументи које користе студенти на основним студијама се односе на познате теорије, а избегавају да употребе прави термин научне идеје на коју се односе. С друге стране, студенти дипломци су били у могућности да дају аргументе

који се односе на посебне аспекте научне теорије, као и да се укључе у аргументоване дискусије које се односе на различите теорије које су имале ограничене аспекте тема о којима се дискутовало у току часа.

Из перспективе учења, резултати ове студије бацају светло на најважније аспекте професионалног усавршавања наставника које имају за циљ да наставници буду свесни улоге питања у промовисању ефективне аргументације међу студентима. Добробит учења за студенте лежи у томе да у аргументованом процесу конструкције новог знања буду активни учесници, а не само слушаоци. Наставници креирају ситуације које подстичу студенте да се упусте у аргументовану расправу, и то представља пример како студенти могу да уче из аргументованих дискусија одређених научних дисциплина (на пример, важне теорије, закони, модели или концепти). Из перспективе аргументоване дискусије, ова студија показује како контекстуализација аргумента представља основу за студију у школском контексту. Употреба аргументационе теорије и аналитичких модела не може да узме у обзир дати контекст: потребно је да се усредсреди на интеракцију између наставника и студента у учионици ради подробне анализе аргументационе динамике која се одвија у учионици.

Кључне речи: Аргументација, високо образовање, квалитативна истраживања, интеракција између наставника и студената, питања наставника.

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Can we Learn through Disagreements? A Sociocultural Perspective on Argumentative Interactions in a Pedagogical Setting in Higher Education

Abstract: *It has been well established by educational research that social interactions play a role in learning and development. In this paper, we draw on recent advances in a sociocultural perspective in psychology that have showed the dialogical dimension of learning, and allowed to consider social interactions as a matrix for its development rather than a variable merely “influencing” psychological processes.*

In educational contexts, argumentative interaction is often considered as a potential means to learn. However, in some cases, the results of argumentative activities do not reach the learning gains expected by the teachers: the students engage in an irenic confrontation trying “to win”, or face difficulties in elaborating counter-arguments and contents which allow an effective epistemic exploration of the topic under discussion. One of the main difficulties for the interlocutors seems “to agree to disagree” and to develop the topic with relevant information. This paper, drawing on a sociocultural perspective on argumentation, has two main objectives: the first is to explain the theoretical outlines of a pedagogical design implemented in a university course in social psychology. This design was conceived in order to lead the students intending to explore a complex question to enter into an epistemic discussion. The second aim is to present and discuss the results of the analysis of the argumentative discussions developed by the students. Did they agree to disagree? How did they manage disagreements? Did their disagreements lead them to an epistemic exploration? The data are made up of 11 chat sessions in which 35 students participated in small groups of 3 or 4. The analysis focuses firstly on the structure of the sessions and secondly on the argumentative moves. The results show that the students co-construct a social frame in which the disagreements can be expressed and the “deep” exploration of the topic can be developed in a cooperative framework. This finding is discussed by examining the role of the general meaning of such a setting in an academic context.

Key words: *sociocultural approach, learning, argumentation, disagreement, design.*

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Introduction

In the context of education, research highlighting the central role of social interactions - and in particular argumentation - in development and learning has induced concrete pedagogical practices. For example, in the new curriculum for primary school in the French-speaking part of Switzerland, the wording “debate” appears many times in the text. It is associated with three main meanings: debate is considered as an object of teaching and learning in itself (as in French lessons when the students are familiarized with argumentative skills, for instance), as a means that allows developing new knowledge and a scientific posture (as in mathematics, sciences and social sciences), but also as a means promoting collaboration among students in order to contribute to “respectful social relationships” (<http://www.plandetudes.ch/>). Social interactions, group discussions and debates have become relatively familiar practices in classrooms. However, today, some criticisms emerge: the actual benefit of group work in terms of learning is more difficult to observe than anticipated and the difficulty of assessing learning gains is tackled. Some researchers in sociology even claim that teaching practices based on debate and group discussions can paradoxically promote social inequalities for the most vulnerable students (Bonéry, 2015).

Taking a sociocultural perspective on argumentation, some authors shed light on the cultural and communicational dimension of argumentation that cannot be reduced to a system of formal procedures but is situated in a relational and institutional setting (Muller Mirza, Perret-Clermont, Tartas & Iannaccone, 2008). Argumentation is framed by the activity in which individuals are involved and the way they provide a meaning to this activity. Moreover, from a conversational perspective, the interlocutors in an argumentative discussion seem to face a double difficulty that Traverso (2001) calls a “contradictory pressure”: the “pressure of the relationship”, that generally in a conversation leads to a preference

for agreement and the avoidance of disagreement, and the “pressure of the content”, i.e. to remain consistent and develop the topic under discussion.

In this paper, we will present and discuss a pedagogical design which intended to lead the participants to “agree to disagree” and to explore a complex question in an epistemic way. This question was taken from a debate in social psychology related to the experience of Jane Elliott about discrimination (this experience, aiming at letting the students experience discrimination, has been criticized for ethical reasons). The pedagogical design we will examine aimed at developing knowledge about discrimination and its psychosocial processes by means of a “role-play” in which the students played the role of psychologists who were asked to help social workers facing racial violence among their own students. In the first section of the paper we will refer to studies on social interactions adopting a sociocultural and dialogical perspective that claim that social interactions cannot be seen as a simple variables that “influence” learning processes. In the second section, we will develop the idea that argumentation is a cultural activity with its own cognitive but also relational, affective and communicative specificities. In the third section, we will present the theoretical outlines of the pedagogical design implemented in a university course in social psychology. After a presentation of the methodological tools we used to analyze our data, made up of 11 chat sessions in which 35 students participated in small groups of 3 or 4, we will discuss the results of the analysis of the argumentative discussions developed by the students. Did they agree to disagree? How did they manage the disagreements? Did their disagreements lead them to an epistemic exploration? The analysis focuses firstly on the structure of the sessions and secondly on the argumentative moves. By examining a specific design and explaining its theoretical background, we hope to contribute to the reflection both on the complexity of interactional processes in knowledge construction and on the conditions of its dynamics.

A Sociocultural and Dialogical Perspective on Interactions and Learning

In the field of research on social interactions, we could distinguish two main strands of studies: one focusing on social interactions as factors of cognitive change, and another considering social relationships as an integral part of human development, in which language is a central cultural artifact for cognitive and social development (Baucal, Arcidiacono, & Buđevac, 2011). In this paper, we adopt the second strand, which we shall call a “sociocultural and dialogical” perspective on social interactions, that considers the interaction as the unit of analysis in which learning is elaborated within complex dynamics, entailing the active participation of the individuals in meaning-making processes, and postulating a central role for the heuristic negotiation of disagreements.

Some scholars who studied the role of social interactions for cognitive development, and in particular socio-cognitive conflicts, in the late 70s and in the 80s (Doise, Mugny, & Perret-Clermont, 1975; Perret-Clermont, 1980), later on shed light on the interpretative processes pertaining to the dynamic of the interaction. Adopting a sociocultural approach, in continuity with authors such as Vygotsky, Mead or Bakhtin, these researchers focused on the dialogical relations of cognitive, relational, affective and institutional dimensions of learning (Grossen, 2009; Muller Mirza & Perret-Clermont, 2009; Muller Mirza, 2014; Perret-Clermont & Nicolet, 2001; Pramling & Säljö, 2014; Schubauer-Leoni, Perret-Clermont, & Grossen, 1992; Tartas, Baucal, & Perret-Clermont, 2010). In this perspective, social interaction is seen not only as part of human life but also as the engine which drives an individual’s psychological development (Psaltis, Gillepsie, & Perret-Clermont, 2015). Their research then showed that the relational dimension is not an external variable but the *locus* in which the interlocutors are engaged in meaning-making processes. The participants refer to symbolic and material elements pertaining to

the micro-context of the situation and also to past experiences and future situations in which they imagine being involved (Bruner, 1990; Grossen, 2009). For the purpose of this paper, let us focus on some main ideas drawn from this theoretical perspective.

If interactions are at the core of psychological development, a “factorial” definition of their role is not sufficient to understand the dynamics of thinking. In contrast, a dialogical definition of interaction leads to focusing no longer on the individual, but on the relationship between *ego* and *alter* (conceived as individuals but also as different facets of the self) (Grossen, 2014; Marková, 2007; Wertsch, 1991). Some studies show for example that the responses of a child in a test situation are the results of processes of communication between an adult and a child in which both are engaged in an interpretative work aiming at defining the meaning(s) of the situation and the task (Grossen, 2009). The object of inquiry for researchers is not (only) the product of the interaction but the dialogical processes developing during the interaction, with a particular interest in the perspective of the actors and the way they confer meanings on the situation.

Another lesson provided by some of these studies is the idea that tensions, hiatus and conflicts are part of any interaction. Social interactions entail agreements and disagreements (Matusov, 1996), and disagreement is neither nuisance nor obstacle, but on the contrary an essential ingredient of the dialogue. Studies in the field of the socio-cognitive conflict in social psychology of development showed that the confrontation of perspectives, and especially its resolution on a higher plane, can lead children to look for new information, explanation and coordination of the points of view even before the formal operation stage, under certain conditions (Perret-Clermont, 1980). However, the positive effect of a socio-cognitive conflict on development seems conditioned by the mode of regulation of the conflict: the “epistemic conflict regulation” mode, focusing on the correctness or validity of knowledge, seems

more beneficial than a “relational conflict regulation” mode, centered on the relative statuses of the partners (Butera, Darnon, & Mugny, 2011). Opening the scope of a factorial analysis of socio-cognitive conflicts, some researchers pointed out the fact that the situation of socio-cognitive conflict is itself a social situation in which contextual, institutional and identity dimensions are embedded (Baucal, Arcidiacono, & Budjevac, 2013; Grossen, 2009; Muller Mirza, Baucal, Perret-Clermont, & Marro, 2003; Psaltis & Duveen, 2007; Tartas et al., 2010). The way the subjects carry out the task and give responses to their interlocutors is the result of psychosocial processes. This research leads today to studies that focus on the dialogical relationships or tensions that arise between different voices: those pertaining to the here-and-now of discourse as well as those pertaining to the there-and-then of discourse which echoes the voices of absent third parties (Grossen & Salazar Orvig, 2011; Zittoun & Grossen, 2013).

In this perspective, language plays an important role. It is the means for providing information to the other but also and mainly, in Vygotskian words, where intermental processes are transformed into intramental processes (Littleton & Mercer, 2013; Mercer, 2000; Vygotsky, 1988). Language however is not the only semiotic psychological tool. Objects and, in the context of school, books, manuals, black and white boards, software, etc., are parts of the symbolic and material systems of mediation that play an important role in teaching and learning (Cole, 1999; Moro & Muller Mirza, 2014; Sørensen, 2009).

These considerations lead educational scholars to suggest that argumentation, as a social, cognitive and dialogical activity, which develops in social interaction characterized by a disagreement, when there is a “discursive confrontation during which antagonistic responses are provided to a ‘question’” (Plantin, 1996a, p. 11, my translation), might facilitate learning, thinking or, more broadly, the exploration of an object of knowledge. Researchers have

showed that argumentation in educational contexts can lead to the construction of new knowledge, foster the elaboration of agency by the learner and help students to enter into a scientific culture (Baker, 2004; Muller Mirza & Buty, 2015).

Argumentation as a Cultural Activity

Pedagogical activities that aim at teaching and learning topics by means of debate and argumentation might lead, however, to interactional dynamics that were not anticipated by the teachers: in some cases, the students may engage in an irenic confrontation trying “to win” at all cost; in other cases they face difficulties in elaborating counter-arguments and contents to allow an effective epistemic exploration of the topic under discussion. Here again a factorial or linear perspective on argumentation in learning is not sufficient.

Many hypotheses have been developed in order to understand the challenges of argumentation in learning (Andriessen & Schwarz, 2009). Argumentation involves various epistemic and relational abilities: taking a stance towards a content (which is situated in a broader debate), providing reasons (referring not only to the personal goal but also to shared knowledge), using linguistic tools, managing arguments pro and contra, etc. Conversationalists and developmental psychologists suggest other possibilities as well. They help us understand that argumentation is a cultural practice that is situated in specific contexts and governed by implicit rules, and a cognitive activity that a child develops. Voss and Van Dyke (2001) observe that young children have personal experience in conflict situations very early in life. Even though they are unable to verbalize the nature of argument structures, they engage actively in argumentative discussions, using justification and negotiation strategies. However, the knowledge and the experience they have of a specific topic will differ and this knowledge can explain some difficulties faced by young children in responding

to researchers who, in trying to evaluate their “argumentative skills”, ask them to develop arguments and counter-arguments about complex topics such as capital punishment or why people should return to prison: “Whether or not a person is able to perform reasonably in an argumentative situation depends on context, which includes the argument’s contents” (Voss & Van Dyke, 2001, p. 103). Other scholars who study conversation in everyday contexts stress the contextual and identity dimensions of argumentation. Along this line Pontecorvo, Arcidiacono and their colleagues analyze argumentation in family contexts and during family dinners in particular. They show how the context of production, as a secure and familiar setting for exploration, plays an important role in socialization of children (Arcidiacono, 2009). By arguing with significant others, in personally meaningful situations, children learn not only how to argue, how to use language to communicate and think, but also social rules (how to behave, how to ask and respond to whom, what are the accepted codes, etc.), and finally what it means to be and become members of a group (Pontecorvo, Fasulo, & Sterponi, 2001; Stein & Albro, 2001). If argumentative sequences can be observed in family contexts or in other conversational genres such as political debates, it seems however that situations in which the participants discuss critically (van Eemeren & Grootendorst, 2004), develop a “question” (Plantin, 1996b), elaborate the disagreement, explore different positions in a heuristic way, are relatively rare. This operation indeed, in everyday conversation, is submitted to what Traverso (1999), a sociolinguist, calls a “contradictory pressure” between, on the one hand, the “pressure of the relationship” and, on the other, the “pressure of the content”. Let us develop this idea further.

Conversational analysts have shown that one of the best attested patterns is the preference for agreement in the second turn of an adjacency pair. It means that when a person makes an assertion or performs another conversational action, a response that is to be taken as agreeing will typically be im-

mediate, while a response to be taken as disagreeing will be prefaced or delayed (Myers, 2004; Sacks, 1987). Pomerantz (1984) sheds light on the tendency to systematically minimize the disagreement by means of modalisators or of a particular organization of the turns to speak characterized by hesitation, pauses or partial agreement. This is related to the notion of figuration or face management developed by Goffman (1974) and others (Brown & Levinson, 1987). When a divergence is expressed, interlocutors try to preserve their face by minimalizing the threat.

However, participants in a dialogue not only engage in this “face work” but also have to deal with another pressure: that of being “consistent”, i.e. to develop and contribute to the content of the discussion. These two pressures function as a double constraint for the participants who have to both show their consistency and manage the face work.

Argumentation is therefore “embodied” in actual communicative practices, oriented towards certain goals, towards other participants (be they present or physically absent in the situation), and towards specific topics. Argumentation cannot therefore be reduced to a system of formal procedures (Nonnon, 2015; Santos & Leitão Santos, 1999). It is framed by the activity in which individuals are involved, the rules of the conversation, their role expectations, and their definition(s) of the situation. Conceiving argumentation in this perspective means a methodological shift of focus: the unit of analysis is no longer the structure of the discourse, nor the individuals (their competences and skills, their cognitive level of development, etc.), but the “activity” of argumentation involving meaning-making processes.

Argumentation to Learn: the Ingredients for “Argumentative Designs”

The “argumentative” practices used in classrooms aiming at learning a specific topic (for instance

in mathematics) are often oriented towards argumentative skills (giving reasons, supporting evidence, etc.) in situations in which all the participants are already convinced or expect to be convinced, and conform to what is expected of them following a classical didactical contract (Schwarz & Baker, 2015). However, argumentative activities rarely lead to a “co-construction of meaning”. In order to overcome this difficulty, some scholars have made heuristic suggestions. Let us here examine the studies of Neil Mercer and his colleagues in particular.

Drawing from the Vygotskian statement of the interdependency of social interaction, language and development, they observe that in teaching and learning settings, the most productive discursive patterns are those in which the disagreement is not only made explicit but also explored in a joint activity (Littleton & Mercer, 2012, 2013; Mercer & Wegerif, 1999; Rojas-Drummond, 2009). This type of discourse is called “exploratory talk” and is defined in the following terms: “Exploratory talk is that in which partners engage critically but constructively with each other’s ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered. Partners all actively participate and opinions are sought and considered before decisions are jointly made” (Mercer, 2004, p. 146). It means that exploratory talks are characterized by the fact that agreement is postponed, disagreements are expressed and justified, the validity of the statement is an object of discussion, any disagreement is introduced in a cooperative frame and therefore submitted to a negotiation procedure (Mercer, 2000). These authors also insist on the fact that this type of talk should be the result of teaching and reflexive activity on the functioning of communication with students. Teachers therefore play an important role by presenting, explaining and discussing the conversational rules – the “ground rules” – that will support exploratory talk. In this perspective, the heuristic and collaborative exploration of the disagreement appears central.

Studying Argumentative Design in Practice

These theoretical notions can be used as a basis for the design of argumentative settings. This is the idea that I would like to develop now by discussing a concrete example (Muller Mirza, 2015). At the University of Lausanne I give a lecture in socio-cultural psychology on thinking and learning with Master students in psychology. The lecture is taught during a semester (14 lessons of 1 hour and a half a week). Two main topics are developed: the first on dialogue and argumentation in diverse everyday contexts, and in particular in school, and the second on intergroup relationships with a focus on social categorization and discrimination. In order to get an opportunity to practice argumentation in learning and to explore a complex topic, the students are invited to attend different activities as part of the course validation process. The main goal is to tackle the topic of social discrimination and its psychosocial processes by means of a “role-play” in which the students play the role of psychologists who are asked to help social workers facing racial violence among their own students. The social workers are deemed to be interested in getting information about discrimination and racism from the scientific literature in social psychology, and some advice about activities which could help them to reduce the violence among their students. They also ask the “experts” whether Jane Elliott’s experiment could be useful for this purpose. This experiment, well known in social psychology, is called “blue eyes-brown eyes”, and was designed by a teacher, Jane Elliott: one morning, the class of third graders are told by their teacher that blue-eyed people are smarter and better than brown-eyed people, and the next day, she reverses the exercise, promoting brown eyes as better than blue eyes². Jane Elliott conceived this exercise and tested it with her pupils just the day after Martin Luther King Jr was assassinated in 1968. This exercise

2 Frontline “A Class Divided” (1985)
<<http://www.pbs.org/wgbh/pages/frontline/video/flv/generic.html?s=frol02s42cq66&continuous=1>>.

has been at the core of a debate in literature: Jane Elliott and others were convinced by the power of the emotional experience of taking alternatively the role of the discriminator and the discriminated in order to reduce the risk of discrimination in society; other researchers, on the contrary, mainly on ethical grounds, expressed their reluctance to make children feel such strong emotions.

In this perspective, the master students are invited to participate in three main tasks:

1) To prepare for a meeting in which they are supposed to speak as “experts” of psychosocial processes in intergroup relationships. The students in small groups of 3-4 participants have to read papers and books about categorization and discrimination in social psychology, and to organize the discussion;

2) To discuss argumentatively about Jane Elliott’s experiment. In order to sustain the discussion among the students, the role-play is organized around discursive roles: one participant has to take the role of “pro” and another the role of “contra” the idea of using Jane Elliott’s exercise in this context. A third participant takes the role of the discussion moderator. This discussion is mediated by a chat program that allows to record the interaction in writing and therefore to come back to it if necessary;

3) To draw up a collective report at the end of the discussion, in which they describe the psychosocial processes at stake in intergroup communication and “respond” to the social workers about the contributions and limits of Jane Elliott’s experience. They conclude, individually, with a general reflection about what they learned from this exercise, from their student’s perspective.

The design of this exercise integrated some elements learned from the theory about argumentation in educational settings: in order to facilitate the heuristic elaboration of disagreement and sustain the development of exploratory talk, the role-play was meant to lead students to express and examine different perspectives about the “question”; the conceptual preparation with the help of scientific litera-

ture was meant to provide them with contents they could refer to during the argumentative setting in order to develop and elaborate the question more deeply; the chat was meant to mediate the discussion in order to allow them the reflexive stance provided by writing, and facilitate the face work.

Method

Participants

The corpus is made up of 11 chat sessions written by the 35 students attending the course. Each session (that lasted 90 minutes on average) was mediated by a chat tool integrated into a Moodle platform. During the sessions, each participant worked with his or her computer. They had to log in and their name appeared on a window shared by all the students: everybody could then write and see the text of the others in a synchronous way. Each intervention – a “turn-taking” – was automatically associated with the name of the interlocutor and the time. The 11 texts total 29,927 words; i.e. an average of 2,720 words and 90 turn-takings per group.

Let us recall that each group was made up of three or four participants: one played the role of a “Proponent” (in favor of Jane Elliott’s exercise), another of an “Opponent” (contra Elliott’s exercise) and a third of a Mediator (the moderator of the chat discussion). In some groups, a fourth student took the role of a second moderator or of a social worker who participated in the discussion. The instruction for each group was the following: They had to organize a work session among them as “psychologists” in order to both reflect on and mobilize knowledge about a complex topic, and to respond to social workers facing problems of racial violence.

Data Analysis

The analysis of these data has been carried out in two main steps:

1) In order to have a better view of the structure of each session, each of these has been divided into discursive sequences. Chat discussions were observed as structured around three main sequences: an “opening phase”, a “phase of development”, and a “concluding phase”. This step aimed at identifying how the students organized their discussion but also at examining how the “question” was thematized;

2) The second step aimed at examining one of the main elements of an exploratory talk which interested us particularly, i.e. whether and how disagreements were expressed and how they were negotiated in the interactional moves. In this perspective, the analysis has been done by means of a schema elaborated on the basis of the suggestions made by Traverso (1999) and Leitão (2001), aiming at analyzing the “negotiation of the disagreement” in argumentation (see also Muller Mirza, Tartas, et al. 2007). The schema is made of three main elements:

- A1 (argument 1): A proposition and its justification, made by the Proponent (for ex.: “**Speaking for myself, I believe that shedding light on the factors of discrimination will allow to develop tolerance and open-mindedness**”³ [*Pour ma part je suis d’avis que la mise en évidence des facteurs qui sont à l’origine de la discrimination va permettre de développer la tolérance et l’ouverture aux autres*]).
- CA1 (counter-argument 1): Disagreement on A1 or on one element of A1 (for ex. “**The method used by J. Elliott (...) would be considered as a very violent and radical one**”).

3 The extracts are translated from French to English. The original text in French appears in square brackets without any orthographical modification. The names of the students are pseudonyms. Before the activity, the students were told that it was part of the validation of the course and that the teacher would read their text. After validation, they were asked if they agreed that their texts could be used in the framework of a research project.

by the authors of the website Mrax.be” [*La méthode employée par J. Elliott serait (...) jugée très violente et radicale comme le rapportent les auteurs du site web Mrax.be*]).

- R (response): Agreement on A1, on CA1, disagreement on A1, on CA1, or alternative (for ex.: “**to work on prejudice and/or stereotypes actually seems a very relevant idea to me. However, they must be handled carefully**” [*Travailler sur les préjugés et/ou les stéréotypes me semble effectivement être une idée pertinente. Cependant, il faut les traiter avec prudence*]).

For this analysis, it was important to take the content of the discussion into account. I then examined the “dimensions of the debate” to which the participants referred when justifying or attacking the argument of the other. The main dimensions identified are the following:

- 1) The scientific validity of Jane Elliott’s exercise
- 2) The ethical dimension of the exercise
- 3) The emotional pressure felt by the participants
- 4) The characteristics of the population at stake
- 5) The feasibility of the exercise
- 6) The issue of intimate experiencing of racism and discrimination.

Results and Interpretation

The structure of the sessions

Analysis shows that all 11 chat discussions are organized around three discursive sequences of various lengths: an opening phase, a phase of development and a phase of conclusion.

Opening phase

The analysis of the opening phase shows that it includes different discursive actions through which the participants negotiate and co-construct three main issues together: 1) a relational issue (the participants recall and state the reasons underlying their work and the role each of them should play); 2) the general context of the “question” they have to discuss; 3) the terms of the “question” itself. Let us discuss some examples extracted from the chat discussions.

1) The relational issue

Here are two examples. Mary and Melanie, who play the role of moderators in their respective group, open the meeting.

Extract 1

Mary Hello, thank you for being here. Before starting the discussion, I would like to recall our objective and the request which has brought us together today

Bonjour, je vous remercie d'être présentes ici. Avant de commencer notre discussion, je souhaiterai faire un petit récapitulatif de notre objectif et de la demande qui nous réunis ici

Extract 2

Mel We received a request to help them with this situation. The social workers also wish to get an account of the state of the art on this topic. This is what we are meeting to discuss.

Une demande nous a été adressée de leur part, afin de leur venir en aide dans cette situation. Les éducateurs du foyer désirent également avoir un compte-rendu de l'état des connaissances disponibles à ce sujet. Ainsi, nous sommes réunies fin d'en discuter (DAA3).

What do Mary and Mel “do” in these extracts? They settle what is expected from their meeting: to help the social workers to solve a problem, to provide them with an account of the scientific knowledge on the topic. In making this reminder they define the purpose and role underlying their meeting. They also define their own discursive identity and attribute specific roles and functions to the others.

2) The context of the “question”

In this opening phase, the participants, sometimes in a joint activity, provide information about the context of the problem they have to discuss, as one can see in the following example.

Extract 3

1. **Ann** The demand originates from a shelter for teenagers from 15-17 yo with host family difficulties

La demande émane d'un foyer accueil pour adolescents entre 15-17 ans avec des difficultés familiales d'accueil

2. **Rose** The persons, all male, spend the whole week in the shelter and come back home at the week-end

Les individu, tous masculins, passent leur semaine au foyer et rentrent chez eux les week-ends

They eat all together and share collective activities

Ils mangent ensemble et ont des activités communes

On several occasions the social workers have observed a psychological and physical bullying between two groups of young people, made up respectively of people from North Africa, and of a majority of Caucasian people.

A plusieurs reprises, les éducateurs ont constaté un harcèlement psychique et physique entre deux groupes de jeunes, constitués

d'une part de personnes d'origine maghrébine pour les uns et majoritairement d'individus caucasiens pour le second groupe

In this extract 3, Ann (who plays the role of the Opponent) but mainly Rose, the Mediator of the discussion, together explain the context of the request: where does the request come from and what is the specific problem faced by the social workers.

3) The formulation of the problem itself

The participants accomplish another discursive task in this opening phase: to provide further information related to the problem they, as experts, will have to discuss. In the next example, Estella puts the “question” into words and uses the formulation “whether... or” typical of the introduction of a controversial topic.

Extract 4

Estella

The social workers were interested in the study conducted by Jane Elliott and in other designs as well. They would like to know whether or not it is possible and relevant to perform an experiment in the framework of their institution, or to receive suggestions about other methods to be implemented

Les éducateurs s'étant intéressés à l'étude menée par Jane Elliott ainsi qu'à d'autres dispositifs, souhaiteraient savoir s'il possible voire pertinent de mener une expérience au sein de leur institution ou recevoir des propositions de méthodes à mettre place

These examples show that the participants spend some time before entering into the discussion itself in order to “frame” the situation. They seem to

construct and provide elements allowing them to respond to the question of “What is it that’s going on there?” that people ask generally when engaging in a new situation (Goffman, 1974). They select specific elements that will contribute to how they interpret the task to be performed. This process of framing, as we can see here, is the result of the participants’ collective activity. Interestingly, what is explained and defined relates not only to the content of the “problem” (bullying and discrimination between groups of young people in a shelter) but also to the nature of their own relationships in the role-play. By the numerous uses of the pronoun “we”, contrasted with the “they” associated with the social workers, and by formulations such as “this is why we are all here today”, the relationship is settled and defined around the idea of collaboration.

Phase of development

The second phase is the longer. It is made up of numerous arguments, counter-arguments, refutations, explanations, examples, quotations from texts, etc. which develop the “question” about the legitimacy of Jane Elliott’s exercise as a possible solution to the problem of the social workers. In the section “Argumentative moves”, we shall come back to the analysis of the dynamics evolving in this phase.

Concluding phase

From session to session, the concluding phase can be very short (one turn-taking) or longer. Generally we can observe the same two dimensions that were thematized in the opening phase: a focus on the content (the participants, in general the Moderator, synthesized the main points of the discussion) and a focus on the relationship (the participants thank each other and say goodbye).

Here is an example illustrating the way one participant takes time to recall systematically (“firstly”, “secondly”...) and argumentatively (“it has its benefits but...”) the main ideas developed by the group during the session.

Extract 5

Marilyn

Unfortunately, it is time to conclude the meeting. I would like to draw up a summary of the main points we tackled in order to transmit them to the social workers. Firstly, the fact that J. Elliott's experience does not seem without risk. This design has its benefits (...) but it does not seem adapted to the context of the shelter and could provoke more differentiation and violence (...). Secondly the design suggested by Aronson...

Malheureusement il est temps d'achever la séance. J'aimerais donc résumer les éléments importants que nous avons abordés afin de pouvoir les transmettre aux éducateurs. Premièrement le fait que l'expérience de J. Elliott ne semble pas sans risque. Ce dispositif à des avantages (vécu de la discrimination, diminution des stéréotypes) mais elle ne semble pas adaptée au contexte du foyer et pourrait créer plus de différence et de violence (...). Deuxièmement le dispositif proposé par Aronson...

Extract 6 shows a typical example of an explicit focus on the relationship. The words used by the three participants in an articulated way indicate a definition in positive terms of the way they worked together (*rich discussion; valuable cooperation: repetition of mutual thanks, with pleasure...*).

Extract 6

1. Jess:

Yes, indeed, we'll talk about this point during our next meeting. As we are coming to the end of this rich discussion for today, I thank you for your valuable cooperation

Tout à fait, nous en parlerons lors d'une prochaine séance. Pour aujourd'hui, nous arrivons au terme de cette riche discussion et je vous remercie pour votre précieuse collaboration

2. Emy:

Thank you

merci à vous!

3. John:

It was a pleasure

Ce fut un plaisir

4. Paula:

With pleasure, see you

c'était avec plaisir, à bientôt

This closing phase appears then as a sequence in which the participants synthesize what has been said during the discussion (suggestion of scenarios for example) but also, in term of faces, as a sequence in which the participants "repair" a possible threat to the relationship due to an argumentative phase entailing agreements and disagreements.

This first analysis of the structure of the sessions sheds light on the way the sequence of elaboration of the "question" – the phase of development – is actually framed by the participants: it is jointly prepared in the introduction on the double dimension of the content and the relationship. The opening phase aims at defining the situation in terms of the content that will be the subject of the discussion, but also in terms of how to reach the objective together: the focus in general is put on an idea of collaboration rather than of confrontation. The session is also concluded on these two dimensions by focus-

ing on a synthesis of the content of the discussion and compensation of the possible negative effects of the argumentative phase.

The phase of development will probably make visible the intricacy of this double dimension. Let us analyze the argumentative moves in this: How are disagreements – if any – made explicit and negotiated? Do we observe some features of what Neil Mercer and his colleagues call an exploratory talk?

Argumentative moves

The chat sessions of the student groups show a relatively vivid discussion on the topic of Jane Elliott's exercise and its legitimacy. This discussion is characterized by arguments in favor and counter-arguments formulated by the Proponents and the Opponents, referring to the different main dimensions of the debate in terms of contents: the scientific validity of Jane Elliott's exercise, its ethical dimension, the emotional pressure it means for the children, the characteristics of the population at stake (age, gender, etc.), the feasibility of the exercise (time available, skills of the teachers, etc.) and the importance of experiencing racism and discrimination in order to avoid their negative impact. This general observation firstly means that the participants did not use the conversational pattern of preference for agreement in the second turn. Rather they expressed their disagreements. These disagreements were not only expressed but justified, the students offering reasons of their own to back up statements or proposals, through exchanges chained into coherent lines of enquiry rather than left stranded and disconnected (Mercer, 2004).

At this point, three observations can be made.

Firstly, the "chains of lines of enquiry" are made up of several encapsulated sets of Argument-Counter-Argument and Response (A-CA-R): one pattern of A-CA-R generally opens a new pattern of A-CA-R.

Let us discuss an example. During a chat session, Viviana (the Proponent) claims that Elliott's exercise could be a relevant method to be used by the social workers as it has been tested by researchers. She refers to Stewart, Laduke, Bracht, Sweet and Gamarel's study (2003) that showed that the distress of the children was balanced by the fact that the participants were pleased with the experiment and by changes in attitude towards cultural diversity. Sebastian (the Opponent) counter-argues to Viviana by saying that Elliott's exercise is too emotionally loaded, and suggests the use of other activities. Viviana continues and concedes that the students are under pressure, but states (it is precisely the argumentative strategy she uses in her statement) that Stewart's results show that Elliott's exercise is efficient.

Extract 7

Viviana : **If we take Stewart's experiment seriously, students report pressure and distress during the experience, but finally they mostly express satisfaction about their participation**

Si on s'appuie sur l'expérience de Stewart, les étudiants rapportent une grande pression et de la détresse durant l'expérience, mais au final, la plupart sont contents d'avoir participé].

Viviana therefore opposes a counter-argument to Sebastian's counter-argument: the fact that not only the students themselves "express satisfaction", but also that Elliott's experiment has been scientifically tested (unlike the activities suggested by Sebastian).

An interesting discussion on the notion of "validity" then develops between Sebastian and Viviana.

Extract 8⁴

- 1 Viviana: (...) Elliott's experience has an advantage: it has been tested and validated by researchers
- 2 Sebastian: Yes of course. However, these authors do not come out of the blue and have "tested" their own activities if not objectively, at least live. They interpreted positive responses from the teenagers. Validity does not guarantee everything in the human sciences
- 3 Viviana: I am not sure I understand how validity does not guarantee everything in the human sciences?
- 4 Sebastian: Numbers can be made to say anything. I do not mean to put into question Stewart's experiment, but one cannot legitimize everything through science! We are talking about teenagers and human beings ; I think that it is clearly more important to take their feelings into account and to place emphasis on positive experiences. With this "pedagogical kit", various activities are related to prejudice and stereotypes. Once again, I think that it is a safe alternative, even though it is not scientifically proven.

- 5 Viviana: Coming back to validity, I perfectly agree that numbers are not the only way to get to the truth. However, I remain convinced that the fact that Elliott's experiment and its long-term effects have been experimentally validated seem to indicate its efficiency.
- 6 Paolo: Thank you for these arguments. In my understanding, it does seem to me that you do not agree on a crucial point. In Elliott's experiment, insight is gained by experiencing discrimination in one's own flesh... ¹

In the first turn-taking of this extract, Viviana claims (A) that Elliott's experiment is relevant, as it has been tested scientifically. She refers to Stewart's paper that she quoted earlier. Defending the cons position, Sebastian's rebuttal (CA) focuses on the notion of "scientific validity" suggested in Viviana's argument. In this perspective, in turn-takings 2 and 4, he makes two points: firstly, he claims that researchers are engaged in an interpretative activity ("they interpreted...") and that they could miss some important information ("they interpreted positive responses...") – meaning that they have could miss "negative responses". He grounds his claim by saying that the researchers in their study were analyzing the design they had themselves set up ("these authors do not come out of the blue... and have tested their own activities"). This point can then question the "scientific" validity of the work quoted by Viviana in order to ground her position. Secondly he suggests that the meaning of "validity" itself cannot be limited to a single frame, that of science in general, but should be related to the context of its

⁴ The original text in French can be found in Appendix 1

production: in this case, as he said, “human sciences”. In so doing, he seems implicitly to oppose two worlds. On one side a world of “human beings” and “feelings”, and on the other, a world of numbers - the world of science. Sebastian insists on the fact that in their specific situation, “it is more important to take feelings into account” [implying “than numbers”], therefore eliminating the argument of scientific validity used by Viviana. However, Viviana, in 5, concedes on a point (there is no universal validity of numbers), but it does not mean that the Stewart’s study does not show a crucial point in Viviana’s eyes: the long-term efficiency of the experiment. With Paolo’s utterance (in 5), another chain of discussion opens on the issue of the subjective experience.

The second observation is that these chains of A-CA-R are often made possible by the help of the participant who acts as the moderator. The moderator takes several discursive actions that permit to elaborate the question more deeply and go beyond the initial disagreement, which could otherwise mean the end of the discussion. The moderator synthesizes the arguments made earlier and points one element of disagreement in particular. He also, as in the next extract, re-opens the debate when a first agreement appears between the Proponent and the Opponent.

Extract 7

Paolo *It seems then that you both agree on the relevance of this experiment. But does it not, in a paradoxical way, have negative effects on the children?*

Il semble donc que tous les deux vous êtes d'accord sur la pertinence de cet expérience, mais est-ce que cela ne pourrait pas provoquer, de façon paradoxale, des effets négatives sur les enfants].

He or she can ask a question of clarification.

Extract 8

Nic *OK.. “skeptical”... but how does the difference in age matter?*

D'accord... “sceptique”... mais quelle différence l'âge peut-elle faire?

Extract 9

Jane *Your discourse is clear but how do you intend implementing this in practice?*

Tes propos sont clairs, mais comment penses-tu mettre cela en place concrètement?

Interestingly, in taking such actions s/he allows avoiding an “agreement on the disagreement” which could also mean the end of the question’s exploration.

However, we can also observe that the participants, Opponents and Proponents, sometimes play the role generally devoted to the Mediator, by articulating, verifying their understanding with questions such as “Do we agree?”, expressing explicitly when they agree or disagree (“I agree with you, but on that point...”, or “I understand your point...”, or “you said that but other experiences show that...”). They therefore make the disagreement explicit in a way that does not disqualify the interlocutors but highlights the importance of “thinking together”.

It happened several times that an agreement on a disagreement opened the door for the elaboration of an alternative, like in a sequence (extract 12) in which the Opponent and the Proponent agree on the fact that Jane Elliott’s exercise is not feasible in the context of a shelter, for ethical and organizational reasons, and together explore the idea of using Elliott’s video and other exercises.

Extract 10

1. Jenny *Yes, you are right. Especially as the personality of the teacher plays a central role. I think that not anyone could play this*

role and have such an impact. Let us look then for another design to be set up...

Oui, vous avez raison. Surtout que la personnalité de l'enseignante joue un rôle déterminant. Je pense que n'importe qui ne pourrait pas jouer ce rôle et avoir un tel impact. Donc cherchons plutôt un autre dispositif à mettre en place...

2. Kim

OK. I have an idea! We could suggest an outreach session by watching the video of Jane Elliott's experiment. In doing so, it would allow a first awareness...

OK. J'ai une idée! Nous pourrions proposer une séance de sensibilisation en visionnant la vidéo de l'expérience de Jane Elliott. De ce fait, cela permettrait une première prise de conscience...

3. Jenny

Yes, but it would also be a good idea to suggest other outreach workshops in order to keep this awareness vivid

Oui, mais à ce moment là il serait bien aussi de proposer d'autres ateliers de sensibilisation pour maintenir cette prise de conscience

The third observation is related to the role of concession. In all the 11 chat sessions written by the students, we can observe an important occurrence of the form “yes, but”, generally prefacing the

expression of disagreement. The word “but” appears in the fourth position of the most used words (of 3 letters and more) in the 11 texts. A deeper analysis of 5 chat sessions (377 turns of speaking and 15'995 words) shows that “but” and “however” (in French: *mais, néanmoins, toutefois*) appear together 83 times (that represents 0.51% of the weighted percentage, calculated with Nvivo10) when introducing a counter-suggestion or a concession. In general, the “yes, but” is used by the Opponent (37%) but also the Proponent (33%) and the Moderator (20%) or by other participants (10%).

The word “but” has numerous functions in discourse. Generally it is meant to avoid a direct confrontation. However, in the chat sessions, other functions can be mentioned such as the introduction of a counter-argumentation or of a doubt that allows the participants to come back to a specific element of the discussion. Sometimes, the concession is integrated in the argument itself (as seen in extract 7), making counter-argumentation more difficult.

If we observe that out of the 11 groups' chat sessions, 7 conclude by not suggesting the use of Jane Elliott's exercise and 4 suggest using Jane Elliott's exercise – or only its video and subject to specific training, a debriefing and/or coordination with other exercises - we can make the hypothesis that the “yes, but” has major argumentative force.

Conclusion

They are many ways to consider the role of social interactions in development and learning. If we agree to simplify the epistemological and methodological diversity of research in this field, we could distinguish two main strands of studies: one strand focusing on the social interactions as factors of cognitive change, and another considering social relationships as an integral part of human development, in which language is a central cultural artifact for cognitive and social development. In this paper we adopted this “sociocultural and dialogical” per-

spective on social interactions that considers that the unit of analysis is the interaction as a whole, in which learning is elaborated within complex dynamics entailing the active participation of the individuals in meaning-making processes. In an educational context, a dialogical approach to social interactions entails two main assumptions among others: firstly, the idea that teaching and learning through social interactions can generate unexpected results, like producing irenic behaviors or passivity by the students, and secondly, the idea that disagreements and tensions are not only part of any interaction but can also be ingredients in knowledge construction.

With this (paradoxical) point of departure, in this paper, I presented a pedagogical design in which the participants were invited to discuss a complex topic in social psychology in an argumentative way. The results of the analysis of the discussions, written by master students in psychology during chat sessions, show that the double constraint attested in literature, related to the preference for agreement and the pressure to be consistent, appears less strong than in everyday conversations: the students not only express their disagreements but also explore them in a cooperative framework by submitting them to a negotiation procedure, using argumentative strategies and knowledge contents. The general pattern of the discussions could then be put in parallel with exploratory talks, as defined by Mercer. The other interesting point is that the students seem involved in an important discursive and collaborative work at two levels: at the level of the content (concepts, studies in social psychology and experiments are called upon in order to back up or refute an argument) and at the level of the relationship (strategies of face management – prefacing, repair, modalisators... – definition of the respective roles, verification of a mutual agreement, etc. are important part of the discussion).

These promising findings may be explained (and put into perspective, tempered also) by various features. The sequentialized design that provides time to read and search for information about the

topic under discussion before entering the argumentative phase; the format of role-play of the setting that permits a certain distance and freedom to express oneself; the mediation by the chat software that, despite some technical issues, may open space for a reflexive posture. We also have to take into consideration the institutional frame of the experiment: the participants are students (between 25-30 years on average) and not children, quite familiar with academic writing. The fact that the exercise is part of an assessment could also explain the relative richness of the productions. Another point is that this activity could be associated with a professional setting for the participants who are engaged in training in psychology: they had to take on the role of experts in psychology, in a situation which could look close to a professional context of their future position. A student wrote in her personal account, at the end of the exercise:

With the chat exercise and the drawing up of the report we faced in vivo situations that, in my opinion, brought us close to 'field reality' (...). The problems we faced (the different languages, use of the software, physical distance and collaborative writing) are realities that one can meet in parasocial professions. The setting was not so artificial after all.

L'exercice du babillard et de la retranscription du rapport nous ont confrontés à des situations in vivo qui s'approchent à mon sens de la 'réalité du terrain' trop souvent occultée (...). Les soucis que nous avons eu (différence de langue, utilisation de la plateforme informatique, éloignement et rédaction en collaboration) sont des réalités que chacun peut rencontrer dans l'exercice d'une profession parasociale. La situa-

tion artificielle ne l'était en fin de compte pas tant que ça.

Further analyses are needed in order to better understand the complex articulation between social interactions and learning. Of course the reference to (sometimes complacent) discourses of the participants is not enough to evaluate learning benefits of a pedagogical setting. Methodological tools should therefore be developed at different levels and

times of the process of learning. It could be interesting for instance to examine if and how the competences mobilized in this training setting are used and useful in the professional contexts in which the students will be involved. Argumentative abilities are an important part of the professional identity of psychologists and scholars in education, although too often neglected in the academic context.

Acknowledgment

I warmly thank the students who participated in the lecture, and who contributed to the discussion of the results presented in this paper.

Appendix

Extract 7 (original text in French)

- 1 Viviana: (...) *L'avantage de l'expérience d'Elliott, c'est qu'elle a été testée et validée par des chercheurs*
- 2 Sebastian: *Oui bien-sûr. Néanmoins, ces auteurs ne sortent pas de nulle part et ont "testé", si ce n'est pas objectivement au moins en direct, leurs activités. Ils y ont vu des réponses favorables des adolescents. La validité n'est pas garante de tout en sciences humaines.*
- 3 Viviana: *Je ne suis pas sûre de bien comprendre en quoi la validité n'est pas garante de tout en sciences humaine?*
- 4 Sebastian: *On fait dire n'importe quoi aux chiffres. Je ne veut pas remettre en doute l'expérience de Stewart, mais on ne peut pas tout légitimer par la science!! On parle d'adolescents et d'êtres humains, je pense qu'il est clairement plus important de prendre en compte leurs ressentis et de se focaliser sur des expériences positives. Par ce kit, plusieurs activités sont relatives aux préjugés et aux stéréotypes. Je pense toujours que c'est une bonne alternative, même si elle n'a pas été prouvée scientifiquement*
- 5 Viviana: *Pour rebondir sur la validité, je conçoit parfaitement que les chiffres ne sont pas seuls porteurs de vérité. Néanmoins, je reste persuadée que le fait que l'expérience d'Elliott et ses effets à long terme ont été validés expérimentalement semble néanmoins indiquer que cette expérience est efficace. (...)*
- 6 Paolo: *Merci pour ces arguments. En tout cas il me semble de comprendre que vous n'êtes pas d'accord sur un point crucial de l'expérience d'Elliott. En effet, dans son expérience, le fait de vivre sur la propre peau l'expérience de discrimination est la source de "l'insight". Il s'agit d'une souffrance et d'une anxiété constructives. Dans cette logique, il semblerait que les activités proposées par Marc s'arrêtent peut-être à un niveau trop superficiel. Est-ce que vous pouvez développer cet argument?*

References

- Andriessen, J., & Schwarz, B. (2009). Argumentative design. In N. Muller Mirza & A.-N. Perret-Clermont (Eds.), *Argumentation and education* (pp. 145-174). New York: Springer
- Arcidiacono, F. (2009). Cultural practices in Italian family conversations: Verbal conflict between parents and preadolescents. *European Journal of Psychology of Education*, 24(1), 97-117.
- Baker, M. J. (2004). *Recherches sur l'élaboration de connaissances dans le dialogue*. Nancy: Université Nancy 2.
- Baucal, A., Arcidiacono, F., & Buđevac, N. (2011). Reflecting on different views of social interaction: Explanatory and analytic perspectives. In A. Baucal, F. Arcidiacono & N. Buđevac (Eds.), *Studying interaction in different contexts: A qualitative view* (pp. 233-251). Belgrade: Institute of Psychology.
- Baucal, A., Arcidiacono, F., & Budjevac, N. (2013). "Is there an equal (amount of) juice?" Exploring the repeated question effect in conservation through conversation. *European Journal of Psychology of Education*, 28(2), 475-495.
- Bonnéry, S. (Ed.). (2015). *Supports pédagogiques et inégalités scolaires*. Paris: La dispute.
- Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage*. Cambridge: Cambridge University Press.
- Bruner, J. (1990). *Acts of meaning*. London: Harvard University Press.
- Butera, F., Darnon, C., & Mugny, G. (2011). Learning from conflict. In J. Jetten & M. J. Hornsey (Eds.), *Rebels in groups: dissent, deviance, difference and defiance* (pp. 31-49). Chichester, etc.: Wiley-Blackwell
- Cole, M. (1999). Cultural psychology: Some general principles and a concrete example. In Y. Engeström, R. Miettinen, & R.-L. Punamäki (Eds.), *Perspectives on activity theory* (pp. 87-106). Cambridge: Cambridge University Press
- Doise, W., Mugny, G., & Perret-Clermont, A.-N. (1975). Social interaction and the development of cognitive operations. *European Journal of Social Psychology*, 5, 367-383.
- Goffman, E. (1974). *Frame analysis: An essay on the organization of experience* New York: Harper & Row.
- Grossen, M. (2009). Social interaction, discourse and learning. Methodological challenges of an emergent transdisciplinary field. In K. Kumpulainen, C. E. Hmelo-Silver, & M. César (Eds.), *Investigating classroom interaction: Methodologies in action* (pp. 263-275). Rotterdam: Sense
- Grossen, M. (2014). L'intersubjectivité dans l'étude des processus d'enseignement-apprentissage: Difficultés et ambiguïtés d'une notion. In C. Moro, N. Muller Mirza, & P. Roman (Eds.), *L'intersubjectivité en questions: Agrégat ou nouveau concept fédérateur pour la psychologie?* (pp. 139-160). Lausanne: Antipodes
- Grossen, M., & Salazar Orvig, A. (2011). Third parties' voices in a therapeutic interview. *Text & Talk*, 31(1), 53-76. doi: DOI 10.1515/TEXT.2011.003
- Leitão, S. (2001). Analyzing Changes in View During Argumentation: A Quest for Method. *Forum Qualitative Sozialforschung/ Forum: Qualitative Social Research* [On-line Journal], 2(3). Available at: <http://www.qualitative-research.net/fqs/fqseng.htm>
- Littleton, K., & Mercer, N. (2012). Educational dialogues. In K. Hall, T. Cremin, B. Comber, & L. Moll (Eds.), *The Wiley Blackwell international handbook of research on children's literacy, learning and culture*. Oxford: Wiley Blackwell

- Littleton, K., & Mercer, N. (2013). *Interthinking: Putting talk to work*. London: Routledge.
- Marková, I. (2007). *Dialogicité et représentations sociales*. Paris: Presses Universitaires de France.
- Matusov, E. (1996). Intersubjectivity without agreement. *Mind, Culture and Activity*, 3(1), 25-45.
- Mercer, N. (2000). *Words and mind. How we use language to think together*. London, New York: Routledge.
- Mercer, N., & Wegerif, R. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, 25(1), 95-111.
- Moro, C., & Muller Mirza, N. (2014). *Psychologie du développement, sémiotique et culture*. Lille : Presses universitaires du Septentrion.
- Muller Mirza, N. (2015). Les paradoxes de l'argumentation en contexte d'éducation: s'accorder sur les désaccords. Analyse d'interactions argumentatives dans un dispositif de formation en psychologie à l'Université. In N. Muller Mirza & C. Buty (Eds.), *L'argumentation dans les contextes de l'éducation* (pp. 167-195). Berne: Peter Lang.
- Muller Mirza, N., & Buty, C. (2015). *L'argumentation dans les contextes de l'éducation*. Berne: Peter Lang.
- Muller Mirza, N., & Perret-Clermont, A.-N. (2014). Are you really ready to change? An actor-oriented perspective on a farmers training setting in Madagascar. *European Journal of Psychology of Education*, 1-15. doi: 10.1007/s10212-014-0238-1
- Muller Mirza, N., & Perret-Clermont, A.-N. (Eds.). (2009). *Argumentation and education: Theoretical foundations and practices*. New York: Springer.
- Muller Mirza, N., Baucal, A., Perret-Clermont, A.-N., & Marro, P. (2003). Nice designed experiment goes to the local community. *Cahiers de Psychologie (Université de Neuchâtel)*, 38, 17-52.
- Myers, G. (2004). Agreeing and disagreeing: Maintaining social argument *Matters of opinion: Talking about public issues* (pp. 112-133). Cambridge: Cambridge University Press
- Nonnon, E. (2015). Préface. In N. Muller Mirza & C. Buty (Eds.), *L'argumentation dans les contextes de l'éducation* (pp. 1-11). Berne: Peter Lang
- Perret-Clermont, A.-N. (1980). *Social interaction and cognitive development in children*. New York: Academic Press.
- Perret-Clermont, A.-N., & Nicolet, M. (2001). *Interagir et connaître*. Paris: L'Harmattan.
- Plantin, C. (1996a). *L'argumentation*. Paris: Seuil.
- Plantin, C. (1996b). Le trilogue argumentatif. Présentation de modèle, analyse de cas. *Langue Française*, 112, 9-30.
- Pomerantz, A. (1984). Agreeing and disagreeing with assessments: Some features of preferred/dispreferred turn-shapes. In J. M. Atkinson & J. Heritage (Eds.), *Structures of social action. Studies in Conversation Analysis* (pp. 79-112). Cambridge: Cambridge University Press
- Pontecorvo, C., Fasulo, A., & Sterponi, L. (2001). Mutual apprentice : the making of parenthood and childhood in family dinner conversations. *Human Development*, 44, 340-361.
- Pramling, N., & Säljö, R. (2014). À propos de la terre et d'autres choses... Des questions, des réponses et l'apprentissage de la catégorisation chez de jeunes enfants en classe de sciences. In C. Moro, N. Muller Mirza, & P. Roman (Eds.), *L'intersubjectivité en questions. Agrégat ou nouveau concept fédérateur pour la psychologie?* (pp. 185-210). Lausanne: Antipodes

- Psaltis, C., & Duveen, G. (2007). Conservation and conversation types: Forms of recognition and cognitive development. *British Journal of Developmental Psychology*(25), 79-102.
- Psaltis, C., Gillepsie, A., & Perret-Clermont, A.-N. (2015). *Social Relations in Human and Societal Development*. Basingstokes (Hampshire, UK): Palgrave Macmillan.
- Rojas-Drummond, S. (2009). Rethinking the role of peer collaboration in enhancing cognitive growth. *Human Development*, 52, 240-245. doi: 10.1159/000215073
- Sacks, H. (1987). On the preference for agreement and contiguity in sequences in conversation. In G. Button & J. R. Lee (Eds.), *Talk and social organization* (pp. 54-69). Clevedon: Multilingual Matter
- Santos, C. M., & Leitão Santos, S. (1999). Good argument, content and contextual dimensions. In J. Andriessen & P. Coirier (Eds.), *Foundations of argumentative text processing* (pp. 75-96). Amsterdam: Amsterdam Press
- Schubauer-Leoni, M. L., Perret-Clermont, A. N., & Grossen, M. (1992). The construction of adult-child intersubjectivity in psychological research and in school. *Social representations and the social bases of knowledge. Swiss monographs in psychology*, 68-77.
- Sørensen, E. (2009). *The materiality of learning: technology and knowledge in educational practice*. New York: Cambridge University Press.
- Stein, N. L., & Albro, E. R. (2001). The origins and nature of arguments: studies in conflict understanding, emotion, and negotiation *Discourse Processes*, 32, 113-133.
- Stewart, T. L., Laduke, J. R., Bracht, C., Sweet, B. A., & Gamarel, K. E. (2003). Do the “Eyes” have It? A program evaluation of Jane Elliott’s “Blue-Eyes/Brown-Eyes”. Diversity training exercise. *Journal of Applied Social Psychology*, 33(9), 1898- 1921.
- Tartas, V., Baucal, A., & Perret-Clermont, A.-N. (2010). Can you think with me? The social and cognitive conditions and the fruits of learning. In C. Howe & K. Littleton (Eds.), *Educational Dialogues: Understanding and Promoting Productive Interaction* (pp. 64-82): Elsevier Advances in Learning and Instruction Book.
- Traverso, V. (1999). *L'analyse des conversations*. Paris: Nathan
- van Eemeren, F. H., & Grootendorst, R. (2004). *A systematic theory of argumentation. The pragma-dialectical approach*. Cambridge: Cambridge University Press.
- Voss, J., & Van Dyke, J. (2001). Argumentation in psychology : Background comments. *Discourse Processes*, 32(2&3), 89-111.
- Vygotsky, L. S. (1988). *Thought and language*. London: Cambridge University Press & MIT Press.
- Wertsch, J. V. (1991). *Voices of the mind: A socio-cultural approach to mediated action*. London: Harvester Wheatsheaf.
- Zittoun, T., & Grossen, M. (2013). Cultural elements as means of constructing the continuity of the self across various spheres of experience. In B. Ligorio & M. César (Eds.), *Interplays between dialogical learning and the dialogical self* (pp. 99-125): Information Ag.

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Можемо ли да учимо кроз неслагање? Социокултурно виђење аргументативних интеракција у педагошком окружењу у високом образовању

Током истраживања у образовању јасно је уочено да социјална интеракција игра веома битну улогу приликом учења и развоја. У овом раду се бавимо скорашњим напретком социокултурне перспективе у психологији која је показала дијалошку димензију учења и омогућила да се узме у обзир социјална интеракција као матрица за развој, а не психолошки процес који је променљив и који једва има „утицаја“ (Baucal, Arcidiacono & Buđevac, 2011; Grossen, 2009; Psaltis, Gillespie, & Perret-Clermont, 2015).

У образовном контексту, аргументативна интеракција се узима као потенцијално средство учења. Мада у неким случајевима резултати аргументативних активности не постижу циљеве учења које очекују наставници: ученици се конфронтирају и покушавају да „победу“ или да се суоче са тешкоћама приликом развијања контрааргумента и садржаја који допушта ефектно епистемолошко истраживање теме у оквиру дискусије. Једна од главних потешкоћа саговорника је „слагање са неслагањем“ и развијање теме са релевантним информацијама. Узимајући у обзир социокултурну перспективу у вези са аргументацијом, неки аутори су бацили светло на културну и комуникациону димензију аргументације, која не може да се сведе на систем формалних процедура, већ је смештена у релационо и институционално окружење (Muller Mirza, Perret-Clermont, Tartas & Iannaccone, 2008). Аргументација је уоквирена активностима у које су укључени појединци и начин на који они обезбеђују садржај некој активности. Штавише, из перспективе конверзације, саговорници у аргументативној дискусији се, изгледа, суочавају са дуплим тешкоћама које Траверсо (Traverso, 2001) назива „контрадикторним притиском“: „притиском односа“, аргументација, уопште у разговору, води до слагања и избегавања неслагања и „притиска садржаја“, то јест остаје конзистентна, и развија се тема у току дискусије.

У овом раду представљамо и дискутујемо о педагошком пројекту који је имао за циљ да наводи учеснике да „се слажу или не слажу“ и да истраже комплексна питања на епистемолошки начин, током курса психологије на факултету. Ово питање је узето из дебате из социјалне психологије и односи се на искуство Џејн Елиот у вези са дискриминацијом (ово искуство, које је омогућило студентима да искусе дискриминацију, критиковано је из етичких разлога). Циљ педагошког пројекта био је развијање знања и свести о дискриминацији и њеном психосоцијалном процесу уз помоћ средства „игра по улогама“, у којој су студенти играли улоге психолога, који су замољени да помажу социјалним радницима суоченим са расним насиљем међу студентима. У првом делу рада бавимо се студијама социјалне интеракције која прихвата социокултурну и дијалошку перспективу која тврди да социјалне интеракције не могу да се виде као једноставне варијабле које „имају утицаја“ на процес учења. У другом делу развијамо идеју да је аргументација културна активност са когнитивним и релационим, афективним и комуникативним особеностима. У трећем делу представљамо теоријске оквири педагошког пројекта који је имплементиран у универзитетски курс социјалне психологије.

После презентације методолошких средстава која смо користили за анализу наших података, сачињену од једанаест сесија у којима је учествовало тридесет пет студената, распоређених у групе

по троје или четворо, дискутовали смо о резултатима анализе аргументоване дискусије коју су развили студенти. Да ли се они слажу или не слажу? Како подносе неслагање? Да ли их неслагање води у епистемолошко истраживање? Анализа се усредсређује пре свега на структуру сесија, а онда на аргументоване потезе, методолошким средством, као што је оно које су развили Нил Мерсер и колеге (истраживачки разговор) и Селма Леитао (Selma Leitao 2000). Резултати показују да студенти коконструишу социјални оквир у којем неслагање може да се изрази и „дубоко“ истраживање теме може да се развије. Овај налаз се анализира испитивањем улоге општег значаја као што је окружење у академском контексту.

Испитујући специфичан дизајн и објашњавајући теоријско порекло, надамо се да ћемо допринети одразу и комплексности процеса интеракције и конструкцији услова њене динамике. Важност развоја аргументованих вештина од стране студената, које се односе на одређено професионално поље, такође се наглашава.

Кључне речи: социокултурни приступ, учење, аргументација, неслагање, дизајн.



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Attachment in the student-teacher relationship as a factor of school achievement

Abstract: *The purpose of this study was to find out how are the quality of student-teacher interaction and teachers' practices related with school achievement during the primary education. A sample of 366 students attending 4th and 7th grades from Belgrade primary schools participated in the study. We developed a questionnaire measuring seven dimensions of student-teacher attachment (Proximity seeking, Separation protest, Particularity, Safe haven, Secure base, Open communication, and Closeness), and six dimensions of teacher practices (Strict, Leadership, Instructional support, Helping/friendly, Conflict, and Dissatisfaction). The parallel versions of questionnaire, for class teacher in 4th grade, and Math teacher in 7th grade were developed. Based on exploratory factor analysis these dimensions were reduced on fewer number of factors. As educational outcomes, we measured students attitude towards school and learning and school marks. Factors Attachment to teacher, Instructional support, Positive emotional relationship with students, students' Positive attitudes towards school and learning and school marks were taken for structural equation modeling, for each grade separately. Results show that Attachment to teacher affects students Attitudes towards school and learning in both grades and school marks just in 4th grade. In 4th grade, quality of Instructional support and teachers' Positive relationship with students have effect on students' Attachment and directly, on school marks and students' Attitudes towards school and learning, respectively. In 7th grade, quality of teachers' Instructional support has effect on Math marks, while teachers' Positive emotional relation with students affects students' Attachment and Math marks. Results are discussed in the light of the attachment to teacher and the quality of student-teacher socio-emotional interaction as factors that foster teaching and learning.*

Key words: *attachment to teacher, instructional support, school achievement.*

Developmental theory and researches provide strong support for the idea that it is the daily interactions that children have with adults and peers that drive learning and development (Bronfenbren-

ner & Morris, 1998). Typically, educational researches are focused on the cognitive aspects of learning and student-teacher interaction. Increasing number of studies has indicated that children's well-being in the school and the emotional quality of teach-

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er-student interactions are fundamental for school adjustment, learning and achievements (Baker et al., 2003; Catalano et al., 2004; Pekrun, 2005; Sakiz et al., 2012; Wubbels & Brekelmans, 2005). In this research we study the importance of teacher-child emotional relationship from perspective of the attachment theory.

In spite of different conceptualization, there is a growing convergence in the literature about the importance of emotional and relational constructs such as children's sense of relatedness (Connell, 1990), belongingness (Goodenow, 1993a), school bonding (Catalano et al., 2004), emotional and instructional support (Hamre et al., 2013), educational emotions (Pekrun, 2000; 2005), positive teacher-child relationship (Howes & Hamilton, 1992; Pianta, 1999) or student-teacher attachment (Bergin & Bergin, 2009) as contributors to school success. Positive teacher-child relationships provide children with the emotional security necessary to engage fully in learning activities and scaffold the development of key social, behavioral, and self-regulatory competencies needed in the school environment (Pianta, 1999). Despite its importance, there is little research examining the nature or significance of teacher-student relationships during the elementary school period (Baker, 2006).

In this paper we analyze effects of teacher-students socio-emotional interaction from the perspective of Attachment theory. First, we briefly review the concept of attachment. Then we analyze the relationship between attachment to parents and school achievements. Finally, we discuss a student-teacher attachment relationship. In the methodology, we describe in details present study. Then we present results and discuss their implications for educational practice and research.

Attachment

Many studies of teacher-child relationship quality have their roots in attachment theory. Attachment is a system of behaviors aimed at establishing and maintaining closeness and contact with an adult figure who is sensible and responsive to the child needs (Bowlby, 1958). Attachment theorists posit that when significant adults provide emotional support and a predictable, consistent, and safe environment, children become more self-reliant and are able to take risks as they explore and learn because they know that an adult will be there to help them (Bowlby, 1969). Studies have shown that securely attached children have better early cognitive development because of activation and maintenance of exploration, curiosity and early learning through new experience (Thompson, 2008; Weinfield et al., 2008). When children feel safe and comfortable, complementary exploratory systems, which encourage them to explore, are activated. Attachment figure will serve as "secure base" from which a child can explore the environment. On the other hand, when children are anxious, distressed or frightened, their attachment systems are activated enforcing them to seek for nearness and closeness with their attachment figures (O'Connor & McCartney, 2007).

All children will establish attachment relationships with an adult who take care of them, but the quality of attachment varies, depending on the quality of adult-child interaction. According to attachment theorists, four attachment types can be identified: secure, insecure/avoidant, insecure/resistant and insecure/disorganized or controlling (Main & Cassidy, 1988; Moss & St-Laurent, 2001).

Attachment relationship influences school adjustment and achievement in two ways: through attachment to parents and through attachment to teachers.

Attachment to parents and school success

Large body of studies has shown that secure attachment to parents is linked to cognitive skills and school success (e.g., Van IJzendoorn, Dijkstra, & Bus, 1995; De Ruiter & Van IJzendoorn, 1993). Securely attached children at age 7 achieved higher school grades than insecure children throughout primary and secondary school, after controlling for IQ and prior grades (Jacobsen, Edelstein, & Hofmann, 1994; Jacobsen & Hofmann, 1997). In another study, it has been found that securely attached children have higher math performance at age 16 than their insecure peers (Teo et al., 1996). Researches indicate that secure children have more advanced cognitive skills, including ability, intelligence, memory, and reasoning than insecure children (Spieker, et al., 2003; Van IJzendoorn, Sagi, & Lambermon, 1992) and higher scores on communication, cognitive engagement, and mastery motivation (Moss & St-Laurent, 2001).

In recent studies attachment patterns have been found to predict developmental quotient (Spieker, et al., 2003) and IQ, especially verbal IQ (van IJzendoorn & Van Vliet-Visser, 1988; Stievenart et al., 2011; O'Connor & McCartney, 2007) and academic achievement (Jacobsen & Hofmann, 1997; Moss & St-Laurent, 2001).

In sum, attachment studies suggest that secure children tend to have higher verbal ability, math ability, reading comprehension, and overall academic achievement, and exhibit more curiosity than insecurely attached children (Granot & Mayseless 2001; Pianta & Harbers, 1996; Weinfield et al., 1999). In high school, insecure students, compared to secure students, were more poorly prepared for exams, did not concentrate as well, feared failure, sought less help from teachers, and gave less priority to studies (Larose et al., 2005).

Based on empirical findings, attachment theorists have developed hypotheses to explain associations between attachment and cognitive skills. Spe-

cifically, they assume that secure children engage in more exploration, demonstrate better test-taking skills, receive higher quality maternal instruction and have more supportive social relationships than insecure children (Van IJzendoorn et al., 1995; O'Connor & McCartney, 2007).

Student-teacher attachment relationship

Attachment has two functions relevant to classrooms: attachment provides feelings of security, so that children can explore freely; and attachment forms the basis for socializing children (Bergin & Bergin, 2009). It might be argued that children may use their teacher as a "secure base" for exploring and learning (Bretherton, 1985), for the same sort of emotional security that characterizes the sensitive and responsive parenting (Goosen & Van IJzendoorn, 1990; Howes, Phillipsen, & Peisner-Feinberg, 2000). Similar to parent-child relationships, teacher-child relationships appear to serve a regulatory function with regard to children's social and emotional development (Greenberg, Speltz, & Deklyen, 1993; Pianta, 1999; Murray & Greenberg, 2000) and therefore have the potential to exert a positive or negative influence on children's ability to succeed in school.

On the other hand, while they are attachment-like, not all teacher-student relationships should be characterized as attachment, because they have some, but not all, of the characteristics and fulfill some of the functions of an attachment relationship (Bergin & Bergin, 2009).

Several authors have used concepts from literature on parent-child attachment to define qualities or dimensions of the teacher-child relationship: i.e., secure, avoidant, resistant/ambivalent (Howes & Hamilton, 1993); optimal, deprived, disengaged, confused, and average (Lynch & Cicchetti, 1992); and alternatively, closeness, dependency, and conflict/anger (Pianta, Steinberg, & Rollins, 1995).

Decades of study have shown that the quality of student-teacher relationships, especially en-

couraging and positive interactions, can have an impact on children's learning, social competences and school adaptation (Howes, Hamilton, & Matheson, 1994; Howes & Matheson, 1992; Pianta, Steinberg, & Rollins, 1995; Egeland & Hiester, 1995; Howes & Smith, 1995; Howes, et al., 1990).

Positive teacher–student relationships acts as protective factors for children's social and academic development (Baker, 2006; Pianta et al., 1997; Valiente, et al., 2008) and can be as important as a high quality educational program (Pianta & LaParo, 2003). Positive or “secure” teacher–student relationships are those perceived by teachers to be high in closeness and low in conflict and dependency. They are marked by respect and caring, with children seeing their teachers as sources of security (Pianta, 1999; Rudasill & Rimm-Kaufman, 2009). Teacher–student relationship quality predicted academic indicators of school success during the primary school. Researchers found out that girls experienced more closeness and less conflict with their teachers than did boys; and that closeness decrease during the later years of primary school (Baker, 2006).

In elementary school, distinction is made between *secure* and *dependent* teacher–student relationships. A secure teacher–student relationship is “characterized by trust, feeling in tune with the student, and perceptions that the student feels safe with the teacher, the student would seek help, and the teacher could console the student” (Pianta & Nimetz 1991, p. 384). A dependent relationship (or resistant, Howes & Ritchie, 1999) is characterized by teacher perceptions that the student is “constantly seeking help or reassurance and reacting negatively to separation from the teacher” (Pianta & Nimetz 1991, p. 385).

Evidence suggests that students with warm and sensitive teacher tend to have greater growth in math and reading ability (Pianta et al. 2008), higher scores on achievement tests, more positive attitudes toward school and more engagement in the classroom (Birch & Ladd, 1997; Hamre & Pianta, 2001).

In contrast, children who have conflicted relationships with teachers tend to like school less, experience less self-direction, and show lower levels of cooperation in classroom activities. In sum, empirical studies suggest that secure teacher–student relationships predict greater knowledge, higher test scores, greater academic motivation, than insecure teacher–student relationships (Bergin & Bergin, 2009).

The antecedents of secure teacher–student relationships are very similar to antecedents of secure parent–child attachment. Students are more likely to develop secure relationships when teachers are involved with, sensitive toward, have frequent positive interactions with children (Howes & Hamilton 1992a), hold high expectations for students (Davis, 2003), and support students autonomy during classroom assignments (Gurland & Grolnick, 2003).

Another also important concept in classroom environment research is **school bonding** or belongingness (Goodenow, 1993b; Sakiz et al., 2012). This concept refers to a sense of belonging at school and commitment to academic goals promoted in the school (Bergin & Bergin, 2009; Catalano et al., 2004). Students' sense of belonging involves close relationships with peers and teachers, a commitment to succeed in school, participation in extracurricular activities. School bonding is similar to attachment in the way that it makes children feel secure and valued, allowing them to take intellectual and social challenges and explore new ideas. Empirical studies suggest that school bonding is linked to higher academic achievements (Hawkins et al., 2001; Marchant et al., 2001; Battin-Pearson et al., 2000), less delinquent behaviors (O'Donnell et al., 1995; Simons-Morton et al., 1999), less participation in school bullying or violence (Cunningham, 2007) and rare dropout (Hawkins et al., 2001). School bonding and positive attitudes towards school and learning, can also be seen as an important educational outcome, beside cognitive outcomes like knowledge, skills and competencies, especially from a life long learn-

ing perspective (Gutman & Schoon, 2013; Rychen & Salganik, 2003).

Study rational and aims

In research on emotions in education, what prevail are researches addressing single emotions (like test anxiety) (e.g., Zeidner, 1988), or emotions of teacher *or* emotions of students, and their function and impact on cognitive processes, teaching and learning (e.g., Ashby, Isen, & Turken, 1999). More relational approaches are lacking: approaches that will consider emotional *relationship* between teacher and students as an aspect of psychosocial environment for teaching and learning.

On the other hand, numerous researches are focused on the dynamics of student-teacher *instructional/pedagogical* interactions and how students learn through that interaction. A new direction in contemporary educational studies are qualitative researches focused on the process of student-teacher interaction and specific acts of students and teachers in that interaction. What these researches lack is perspective on more general *emotional relationship* between students and teacher. This emotional relationship is relatively stable and enduring factor affecting not only the dynamics of student-teacher relationship and interaction, but also the process of teaching and learning.

The main purpose of this study was to find out how emotional quality of interaction, specifically teacher-student attachment, and characteristics of teachers' practices are related with two important educational outcomes during the primary education: school achievements and students' positive relationship towards school and learning.

Method

This study was focused on students' interaction with and attachment to teachers at the end of IV and VII grade of a primary school. In the Ser-

bian educational system, during the first four years in primary school, children have one class teacher and from V to VIII grade they have different subject teachers. Taking into consideration that Math is one of the key subject in the curriculum, and that previous studies shown that Math class provoke more students' anxiety (Radišić & Baucal, 2012; Videnović & Radišić, 2011) this study was focused on students' interaction with class teacher in IV grade and with Math teacher in VII grade.

Sample

The questionnaire was administered to a sample of 366 students from five Belgrade primary schools.

Table 1. *Number of students according to gender and grade*

Gender	Grade		
	4 th	7 th	Total
Female	95	91	186
Male	92	88	180
Total	187	179	366

Instrument

There are several instruments assessing different aspects of teacher-student social-emotional relationship and interaction in the classroom. Based on the literature review, for the purpose of this research, we developed a self-reporting questionnaire designed to assess students' perception of teacher behavior in the classroom and of quality of teachers' interaction with their students. Items were adapted from several related scales:

- 1) The Questionnaire on Teacher Interaction (QTI) (Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993; Lourdusamy & Swe Khine, 2001).
- 2) The Classroom Assessment Scoring System (CLASS; Pianta, LaParo & Hamre, 2008)
- 3) The Student Teacher Relationship Scale (STRS; Pianta & Nimetz, 1991)

- 4) The Components of Attachment Questionnaire (CAQ; Parish, 2000; Parish & Eagle, 2003)

This new questionnaire encompasses following dimensions:

1) **The Attachment to teacher** scale is modified the Components of Attachment Questionnaire (Parish, 2000) to measures the degree to which a student perceives her/his teacher as an attachment figure. We used five dimensions of the CAQ:

1.1) Proximity seeking (4 items) measures student's need to be near and close to the teacher (e.g. *Sometimes I miss my teacher when she is not around*).

1.2) Particularity (2 items) measures degree to which a student perceives his/her teacher as a unique, special and irreplaceable figure (e.g. *My teacher is more important to me than most other people are*).

1.3) Separation protest (3 items) measures degree to which student feels anxious or distress upon separation from teacher as attachment figure (e.g. *I feel anxious when our teacher is away*).

1.4) Safe haven (7 items) measures degree to which student perceives his/her teacher as a figure to whom she/he can return for comfort and safety when upset in the school (e.g. *The teacher is available when I need her*).

1.5) Secure base (4 items) measures degree to which student perceives his/her teacher as a secure base for exploration in the school (e.g. *My teacher helps me to explore new ideas*).

Beside these, two dimensions complementary to attachment were added:

1.6) The Closeness –(4 items, from STRS) measures degree to which a student experiences affection, warmth and open communication with a teacher (e.g. *I openly share my feelings and experiences with the teacher*).

1.7) The Open communication (5 items) developed for this research to measure de-

gree to which student perceive that his/her communication with the teacher is open and trusty, that teacher is available and shows understanding (e.g. *When I talk to a teacher, I see that she carefully listens and understands me*).

As antecedents of secure teacher-student relationship, several characteristics of teachers' practices were measured:

- 1) **The Leadership** (QTI) measures degree to which a student perceives his/her teacher as a person who notices what is happening, leads, organizes, sets tasks, structures the classroom situation, explains, holds the attention (e.g. *This teacher knows everything that goes on in the classroom*).
- 2) The Instructional Support (10 items; CLASS, TIMSS, PISA) measures degree to which student perceives pedagogical support that teacher provides to them and perceives teacher's feedback as focused on expanding learning and understanding (e.g. *When I answer in the class, teacher explains what was good and what was wrong*).
- 3) **The Strict** (3 items; QTI) describes teacher who is demanding, who checks, judges, maintains silence, is strict and sets rules and norms (e.g. *The teacher is severe when marking papers*).
- 4) **The Helping and Friendly** (QTI) describes teacher who assists, behaves in a friendly or considerate manner, is able to make a joke (e.g. *The teacher helps us with our work*).
- 5) **The Conflict** (5 items; STRS) measures degree to which a student perceives her or his relationship with a teacher as a negative and conflictual (e.g. *Teacher and I always seem to be struggling with each other*).
- 6) **The Dissatisfied** (QTI) describes teacher who wait for silence, considers pros and cons, keeps quite, shows dissatisfaction, looks glum, questions, criticizes (e.g. *The teacher thinks that we don't know anything*).

The parallel versions of the questionnaire, for class teacher and math teacher were made.

Younger students responded on a three-point Lickert scale to indicate agreement with each statement (Incorrect, Don't know, and Correct) while older student responded on the five-point Lickert scale (from Totally incorrect to Totally correct).

As a measure of students' achievements, two educational outcomes were measured:

- 1) **The school marks:** Because students in 4th grade get all marks from one class teacher, in order to obtain a greater variability of marks, a composite measure was made based on their marks in Math, Serbian language and final mark at the end of the previous school year. For students in 7th grade only Math mark was used.
- 2) **The positive attitude towards school and learning** (Popović Čitić, 2012): this subscale encompasses 7 items that measure: Students' dedication to school and school obligations (*I try to achieve as better grades in school*); School bonding (*I'm happy to spend time in school*); Participation in school activities (*I participate in school sections, additional classes or other extracurricular activities in school*); Respect of the school norms (*I respect the school rules*); Positive attitudes towards learning (*Things I learn in school are important and useful*).

Data on reliability of all subscales are shown in Table 2. As we can see, except two, the rest of the subscales have moderate to high reliability. Due to the low reliability of subscales Strict and Leadership, they were excluded from further analysis.

Table 2. Reliability of subscales for 4th and 7th grade sample

	Cronbach's Alpha	
	4 th grade	7 th grade
Attachment to teacher	.919	.930
Positive attitudes towards school and learning	.650	.723
Strict	.324	.318
Leadership	.361	.543
Instructional support	.601	.719
Positive emotional relationship with students	.548	.555

Procedure

After the students' agreement to participate in this research was obtained, the questionnaire was administered to all students during the class. Completion of questionnaire lasted less than 45 minutes in both 4th and 7th grades.

Results

The current study focused on the relations among dimensions of students' attachment to teacher, and students' perception of teachers' behaviors and interaction on one side, and on the other side, students' school achievements, measured through school marks and students' positive attitude towards school and learning. Separate analyses were done for student from 4th and 7th grade. Considering a large number of dimensions, in order to determine relationship between these dimensions, several EFA were done.

Structure of relationship between attachment dimensions

The EFA for seven dimensions of attachment to teacher has shown that these dimensions together make one factor in both age groups, as it was hypothesized based on conceptual meaning of these dimensions. Using principal component analysis one factor with eigenvalue larger than one was ex-

tracted explaining 64% of variance in 4th grade (eigenvalue=4.47) and 65% of variance in 7th grade (eigenvalue=4.56). This factor is called Attachment to teacher and its structure is shown in Table 3.

Table 3. *Component matrix of the first factor of seven attachment dimensions*

Dimension	Component 1 4 th grade	Component 1 7 th grade
Safe haven	.870	.897
Secure base	.857	.866
Proximity seeking	.826	.807
Closeness	.804	.870
Open communication	.793	.795
Particularity	.720	.671
Separation protest	.711	.716

Students who have high scores on this factor, perceive their teacher as a figure which can comfort them, to whom they can return if they are distressed in school, and also who is secure base for exploration and learning in classroom environment. They seek for nearness and closeness with the teacher, have open communication with her/him, and are dissatisfied when teacher is not around.

Structure of relationship between dimensions of teachers' practices

Second analysis on the dimensions of students' perception of teachers' practices, has shown that dimension Instructional support stands as an independent variable, while dimensions Helping and friendly, Dissatisfied and Conflict make one factor, which explains 68% of variance in 4th grade (eigenvalue=2.028) and 72% of variance in 7th grade (eigenvalue=2.159).

Based on the meaning of these dimensions, this factor is called Positive emotional relationship with students (Table 4).

The Positive emotional relationship factor describes students' perception of their teacher as helpful and friendly, with whom they have rare conflicts

and who exhibits satisfaction with his/her relationship with students.

Table 4. *Component matrix of factor Positive emotional relationship with students*

Dimensions	Component 1 4 th grade	Component 1 7 th grade
Conflict	-.864	-.873
Dissatisfied	-.814	-.841
Helping and Friendly	.786	.830

Relationship between attachment to teacher, school achievements and teachers' practices

The current study focused on the relations among primary school students' Attachment to teacher, students' perceptions of teachers' behaviors and interactions assessed by Instructional support and Positive emotional relationship with students' dimensions, and students school marks and Positive attitude towards school and learning. The relations among these variables were tested using structural equation modeling (SEM) (Byrne, 2001).

In the theoretical model we hypothesized that students' Attachment to teacher will influence his/her school marks and Positive attitude towards school and learning. Besides that, we assumed that students' perception of teachers' practices assessed through dimensions Instructional support, and Positive emotional relationship with student will affect students' attachment to teacher and, independently students marks and Positive attitude towards school and learning. This model is shown in Figure 1.

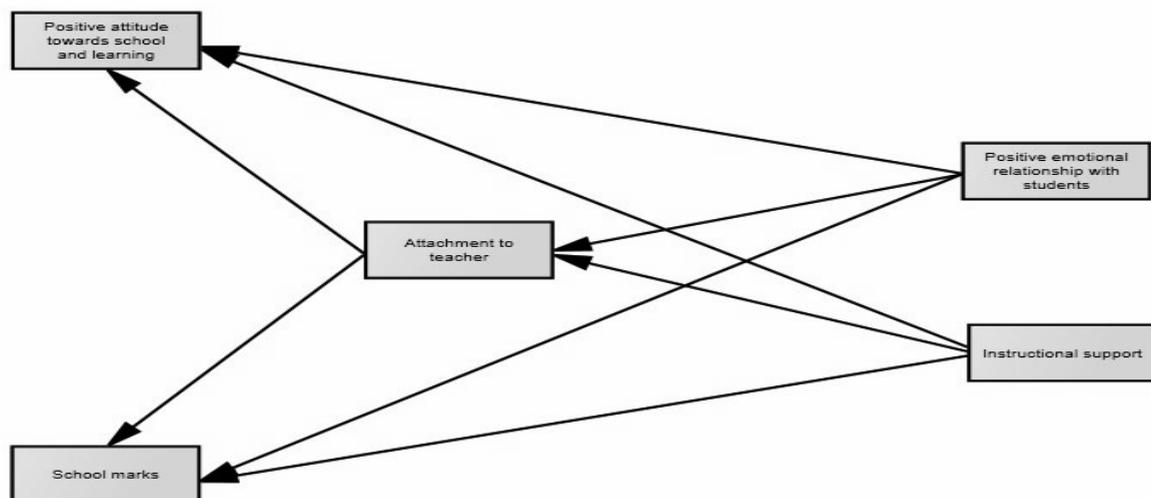


Figure 1: Theoretical model of assumed relationships between dimensions

The SEM model (4th grade)

SEM analysis shows that this theoretical model fits to empirically obtained data ($\chi^2(3) = .991$, $p = .803$, $\chi^2/df = .330$, $RMR = .026$, $GFI = .998$, $RMSEA = .000$) allowing us to analyze individual relations within the model.

As it can be seen from the Figure 2 not all theoretically assumed relationships between variables are statistically significant. Dimension Instructional support does not have direct effect on positive attitudes towards school; and dimension Positive emotional relationship has no effect on school marks. Model in Figure 2 depicts just statistically

significant relationships between variables (parameters are shown in Table 10).

As we can see, Attachment to teacher in 4th grade, has a direct effect on both measures: students' school marks and Positive attitudes towards school and learning. Students in the 4th grade who have warm, close and secure relationship with their teacher have better school achievements as well as they perceive school as something useful and interesting, and themselves as more dedicated to school. On the other hand, students will have more positive and secure relationships with a teacher if a teacher has more positive emotional relationship towards

Table 10. Standardized regression coefficients of the model for 4th grade

Relation		Standardized regression coefficients	Critical ratio	p
Attachment to teacher	----> Positive attitudes towards school and learning	.111	4.810	.000
Attachment to teacher	----> School marks	.619	4.126	.000
Instructional support	----> Attachment to teacher	.297	4.692	.000
Instructional support	----> School marks	.404	2.691	.007
Positive emotional relationship	----> Attachment to teacher	.420	6.646	.000
Positive emotional relationship	----> Positive attitudes towards school and learning	.122	5.315	.000

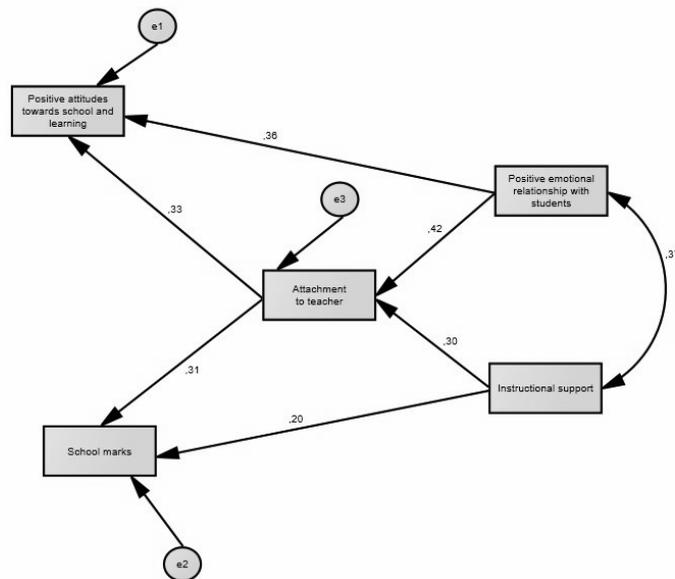


Figure 2: Parameters of the model of relations between students attachment to teacher, dimensions of teacher behavior and students school achievements in 4th grade (standardized regression coefficients)

students and offers them more instructional support.

Teachers' positive emotional relationship towards students and a quality of instructional support have also a direct influence on students' positive attitudes towards school and school marks, respectively, beside their indirect effect through the students' attachment to teacher. If a teacher has more positive emotional relationships with students, students will have more positive attitudes towards school and learning. But this positive emotional relationship will have no influence on students' marks. If teacher gives more instructional support and higher quality of feedback to students, they will have better school marks, but it will not influence their attitudes towards school.

Model in Figure 2 also shows that dimensions of teacher behavior are correlated. Dimension Positive emotional relationship is correlated with Instructional support. Teachers who have more positive emotional relationships with students will give more instructional support.

The SEM model (7th grade)

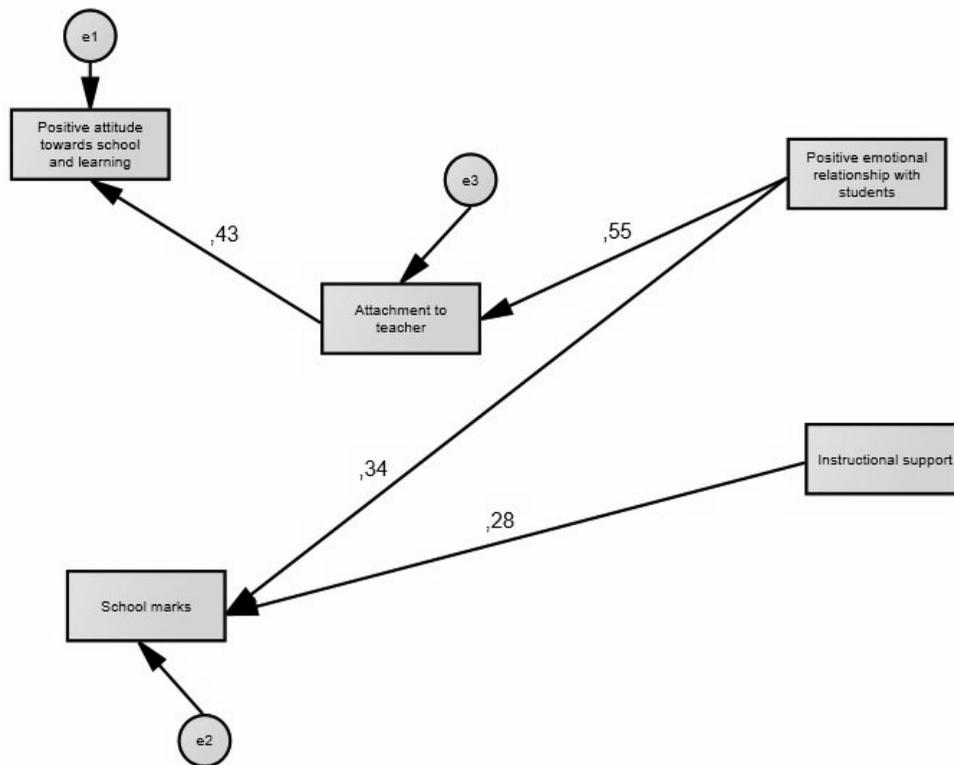
The same theoretical model of relations between variables was applied on data from 7th grade students. This theoretical model fits to empirically obtained data on older sample, which means that this model can reproduce matrix of covariances of tasted variables ($\chi^2(6) = 6.372$, $p = .383$, $\chi^2/df = 1.062$, RMR = .050, GFI = .986, RMSEA = .019).

Model obtained for 7th grade sample data also has theoretically assumed relationships between variables that are not statistically significant. Attachment to Math teacher has no effect on Math marks, Instructional support does not affect neither Attachment to teacher and Positive attitudes towards school. Dimension Positive emotional relationship with students have no effect on Positive attitudes towards school.

Model in Figure 3 depicts just statistically significant relationships between variables. Values of statistically significant parameters of the model for 7th grade are shown in Table 11.

Table 11: Standardized regression coefficients of the model for 7th grade

	Relation	Standardized regression coefficients	Critical ratio	p
Attachment to teacher	-----> Positive attitudes towards school and learning	.331	6.270	.000
Instructional support	-----> Math marks	.303	4.211	.000
Positive emotional relationship	-----> Math marks	.370	5.134	.000
Positive emotional relationship	-----> Attachment to teacher	.554	8.870	.000

Figure 3: Parameters of the model of relations between students attachment to teacher, dimensions of teacher behavior and students school achievements in 7th grade (standardized regression coefficients)

Attachment to Math teacher in 7th grade has a direct effect only on a students' Positive attitudes towards school and learning, but not on students' Math marks. An emotional relationship with a teacher will have effect on general emotional attitude towards school, but will not affect school achievements.

On the other hand, students will develop attachment relationship with Math teacher if they perceive him/her as helpful, friendly and satisfied.

On this age level, Math marks are under the influence of two dimensions of teachers' behavior: teachers' Positive emotional relationship with students and quality of Instructional support. Students in 7th grade will have better Math marks if a teacher is giving more or better instructional support, and she/he is helping and friendly, satisfied and has rare conflicts with students.

Model in Figure 3 shows that there is no relations among dimensions of teacher behavior. According to seventh grade students, teachers' positive emotional relationship with students have no relation with the quality of teachers' instructional support.

Interpretation and discussion

The goal of this study was to analyze direct and indirect relations between teachers' behaviors and practices, student-teacher attachment relationship and educational outcomes. The findings extend our understanding of relationships between the student-teacher attachment and students school marks and attitudes towards school and learning in primary school. Results show that attachment to class teacher in 4th grade has influence on both school marks and attitudes towards school, while, in 7th grade, attachment to Math teacher has influence just on students' attitudes towards school and learning and not on the Math marks.

The findings about effect of the attachment to teacher on school marks in 4th grade suggest that,

in warm, supportive, "secure" environment students achieve better school results. This finding is in concordance with findings from other researches indicating that secure teacher-student relation support learning and exploration in school, as the relation of the same quality with parents does (Hamre et al., 2013; Krstic, 2012; Bergin & Bergin, 2009; Pianta et al., 2008). If students perceive their teacher as a warm, sensitive, responsive, supporting, if they feel secure and valued, that can encourage them to take on intellectual and social challenges, to explore new ideas and to learn.

The findings also suggest that there are some age differences in effect of student-teacher attachment. Math marks in 7th grade are not under the influence of students' attachment with Math teacher. Students will have better Math marks if Math teacher has just positive emotional relation with them. So, in 7th grade, math teacher does not have to be an attachment figure for students, to comfort and to be a secure base for them, but just to be helpful and friendly, satisfied and non-conflictual. This finding is in concordance with results of earlier studies suggesting that association between the teacher-student relationship and cognitive outcomes is not as consistent as association between that relationship and emotional outcomes (motivation, positive attitudes) (Wubbels & Brekelmans, 2005). However, this finding can also reflect key developmental changes typical for the transition from the middle childhood to the adolescence. For first four years of primary school, students have one class teacher for all subjects. In the same time, they still have a need for a stable, warm and sensitive adult figure. A class teacher can serve as a "parent" in the school and if a class teacher is warm and sensitive, student will develop attachment relationship. From 5th grade, students have different teachers for every subject. Subject teacher spend less time with particular students and develop different relation with them, less warm and sensitive. Besides that, students in 7th grade, being adolescents, have a less need for attachment fig-

ure than younger students. In that age they seek for peer attachments. In their relation with teachers, they make more differentiation between emotional relations and pedagogical support from teachers. So, the quality of instructional support and quality of feedback from teacher affect their marks, but emotional relation with teachers affects only general attitudes towards school.

Our findings show that the positive and secure relation with teacher, affects not only school marks, but also affects development of positive attitudes towards school and learning. Students' positive attitudes towards school and learning, as an important educational outcome, is under the influence of students' attachment to teacher on both ages. On younger age, these positive attitudes are also affected by teachers' positive emotional relationship with students, while on older age, there is no such effect. If younger students have positive and secure relationship with their teacher, if they feel safe to explore and learn, that will affect their overall perception and experience with a school. This finding supports Cornelius-White (2007) claim, that most students who dislike school do so primarily because they dislike their teacher. This is also important because, several studies have linked school bonding to academic achievement (Hawkins, et al., 2001; Marchant et al., 2001; Battin-Pearson et al., 2000). Children who feel a sense of attachment to school and who develop a commitment to succeed in school are more successful academically.

As the antecedents of student-teacher attachment, this study has highlight positive emotional relationship with students on both ages. On younger age, instructional support also affect students' attachment with teacher, while in 7th grade, quality of teachers' instructional support has no influence on students' emotional relation with a teacher. Earlier studies have pointed out teacher characteristics such as caring, interest in, respectful encouraging, fair as associated with several positive educational outcomes: school achievement and attitudes (Bak-

er et al., 2003), increased self-esteem (Reddy et al., 2003); academic achievement (Goodenow, 1993a); academic effort (Wentzel, 1997); classroom engagement (Tucker et al., 2002); school motivation (Stipek et al., 1998). Several studies reported that students prefer teachers who care and hold high academic expectations (Muller, Katz, & Dance, 1999; Murdock, 1999; Davis, 2003; Sakiz et al., 2012). These teacher characteristics may improve the psychological climate of the classroom and increase the feeling of safety, which encourage students' classroom engagement and learning. In a meta-analysis on 119 studies, Cornelius-White (2007) found a moderate correlation across several person-centered teacher variables (such as empathy, warmth, encouraging) and student achievement and attitudes. Another meta-analysis of classroom climate, found that a common attributes that optimize student learning are goal directedness, positive interpersonal relations, and social support (Hattie, 2009). So, we can conclude that student-teacher attachment will develop when a teacher has a positive emotional relationship with students: when he/she is helpful, friendly, satisfied and non-conflictual.

One more important characteristic of teachers' practices that influence students' achievements and quality of relationship with the teacher is instructional support. A quality of teachers' instructional support-pedagogical support and quality of teachers' feedback, has direct influence on both school marks in 4th grade and Math marks in 7th grade. Hamre and her colleagues also found that teachers' instructional support predict students' academic functioning and engagement in classroom activities (Hamre et al., 2013). In 4th grade, instructional support has also important effect on student-teacher attachment.

At the end, based on these findings we can conclude that in the 4th grade secure student-teacher attachment affects both measured educational outcomes, school marks and positive attitudes towards school and learning. Students will develop secure at-

tachment to teacher if a teacher has a positive emotional relationship with students and gives them a high-quality instructional support. In 7th grade, students do not need an attachment figure to have good Math marks. At this level, attachment to teacher will affect students' positive attitudes towards school and learning. Math marks in 7th grade depend on teachers' instructional support and positive emotional relationship with students.

The positive relations between attachment to teacher and students educational outcomes found in this study provide evidence for the importance of developing positive emotional relationship in a classroom and creating warm, sensitive and supporting learning environment in schools. This study suggests that more attention should be paid on emotional relationships between students

and teachers. In a context of positive emotional relationship with the teacher, a large number of students will develop positive attitudes towards school and learning, and in lower grades, they will achieve better school marks. This research also indicates that emotional interaction and attachment are important and fruitful domain for educational researches. Teachers' relationship with students and their practices can be described and measured through large number of different dimensions, in this research we cover just few of them. Also, as our study reveal, there are some age differences that should be taken into consideration. Our understanding of student-teacher interaction and relations could be extended with a qualitative researches which would reveal mechanisms in the base of those relations.

References

- Ashby, F. G., Isen, A. M., & Turken, A. U. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review*, 106, 529–550.
- Baker, J.A. (2006). Contributions of teacher–child relationships to positive school adjustment during elementary school. *Journal of School Psychology* (44); 211–229.
- Baker, J. A., Dilly, L. J., Aupperlee, J. L., & Patil, S. A. (2003). The developmental context of school satisfaction: Schools as psychologically healthy environments. *School Psychology Quarterly*, 18, 206–221.
- Battin-Pearson, S., Newcomb, M.D., Abbott, R.D., Hill, K.G., Catalano, R.F. & Hawkins, J.D. (2000). Predictors of Early High School Dropout: A Test of Five Theories. *Journal of Educational Psychology*, Vol. 92, No. 3. 568-582.
- Bergin, C., & Bergin, D. (2009). Attachment in the Classroom. *Educational Psychology Review* (21):141–170.
- Birch, S. H., & Ladd, G. W. (1998). Children's interpersonal behaviors and the teacher-child relationship. *Developmental Psychology*, 34, 934-946.
- Birch, S., & Ladd, G. (1997). The teacher–child relationship and children's early school adjustment. *Journal of School Psychology*, 35(1), 61–79.
- Bowlbi, J. (1958). The Nature of Child's Tie to His Mother. *International Journal of Psycho-Analysis*, 39, 350-373.
- Bowlby, J. (1969). *Attachment and Loss. Vol 1. Attachment*. New York: Basic Books.
- Bretherton, I. (1985). Attachment theory: Retrospect and prospect. In I. Bretherton & E. Waters (Eds.) *Grownig Points of Attachment Theory and Research. Monographs of the Society for Research on Child Development*, 50(1-2) No. 209, 3-38.

- Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development (5th ed., pp. 993–1029)*. New York: Wiley.
- Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. New Jersey: Erlbaum.
- Catalano, R. F., Haggerty, K. P., Oesterle, S., Fleming, C. B., & Hawkins, J. D. (2004). The importance of bonding to school for healthy development: Findings from the Social Development Research Group. *Journal of School Health, 74*(7), 252-261.
- Connell, J. P. (1990). Context, self, and action: A motivational analysis of self-system processes across the life-span. In D. Cicchetti, & M. Beeghly (Eds.), *The self in transition: From infancy to childhood* (pp. 61–97). Chicago, University of Chicago Press.
- Cornelius-White, J. (2007). Learner-centered teacher-student relationships are effective: A meta-analysis. *Review of Educational Research, 77*(1), 113–143.
- Cunningham, N. J. (2007). Level of bonding to school and perception of the school environment by bullies, victims, and bully-victims. *The Journal of Early Adolescence, 27*(4), 457-478.
- Davis, H. (2003). Conceptualizing the role and influence of student–teacher relationships on children’s social and cognitive development. *Educational Psychologist, 38*(4), 207–234.
- De Ruiter, C., & Van IJzendoorn, M. H. (1993). Attachment and cognition: A review of the literature. *International Journal of Educational Research, 19*, 525-540.
- Den Brok, P., Brekelmans, M. & Wubbels, T. (2006). Multilevel issues in research using students’ perceptions of learning environments: The case of the Questionnaire on Teacher Interaction. *Learning Environment Research 9*:199–213.
- Egeland, B. and Hiester, M. (1995), The Long-Term Consequences of Infant Day-Care and Mother-Infant Attachment. *Child Development, 66*, (2), 474-485.
- Fisher, D., Fraser, B., & Cresswell, J. (1995). Using the “Questionnaire on Teacher Interaction” in the Professional Development of Teachers. *Australian Journal of Teacher Education, 20* (1), 8-18.
- Goodenow, C. (1993a). The psychological sense of school membership among adolescents: Scale development and educational correlates. *Psychology in the Schools, 30*, 79–90.
- Goodenow, C. (1993b). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *Journal of Early Adolescence, 13*, 21–43.
- Goossens, F. & Van IJzendoorn, M. (1990). Quality of infants’ attachments to professional caregivers: Relation to infant-parent attachment and day-care characteristics. *Child Development, 61*, 832-837.
- Granot, D., & Mayseless, O. (2001). Attachment security and adjustment to school in middle childhood. *International Journal of Behavioral Development, 25*(6), 530–541.
- Greenberg, M. T., Speltz, M. L., & Deklyen, M. (1993). The role of attachment in the early development of disruptive behavior problems. *Development and Psychopathology, 5*, 191-213.
- Gurland, S., & Grolnick, W. (2003). Children’s expectancies and perceptions of adults: Effects on rapport. *Child Development, 74*(4), 1212–1224.

- Gutman, L.M & Schoon, I. (2013). *The impact of non-cognitive skills on outcomes for young people*. Education Endowment Foundation. Retrieved August 10, 2015. from https://educationendowmentfoundation.org.uk/uploads/pdf/Non-cognitive_skills_literature_review_2.pdf
- Hamre, B., & Pianta, R. (2001). Early teacher–child relationships and the trajectory of children’s school outcomes through eighth grade. *Child Development*, 72(2), 625–638.
- Hamre, B.K., Pianta, R.C., Downer, J.T., DeCoster, J., Mashburn, A.J. Jones, S.M., Brown, J.L., Cappella, E., Atkins, M., Rivers, S.E., Brackett, M.A., & Hamagami, A. (2013). Teaching through Interactions: Testing a Developmental Framework of Teacher Effectiveness in over 4,000 Classrooms. *The Elementary School Journal*, Vol. 113, No. 4, 461-487.
- Hattie, J. (2009) *Visible learning: a synthesis of meta-analyses relating to achievement*. Routledge, NY.
- Hawkins, J. D., Guo, J., Hill, K. G., Battin-Pearson, S., & Abbott, R. D. (2001). Long-term effects of the social development intervention on school bonding trajectories. *Applied Developmental Science*, 5(4), 225-236.
- Howes, C., & Hamilton, C. E. (1992a). Children’s relationships with caregivers: Mothers and child care teachers. *Child Development*, 63, 859–866.
- Howes, C., & Hamilton, C. E. (1992b). Children’s relationships with child care teachers: Stability and concordance with parental attachments. *Child Development*, 63, 867–878.
- Howes, C., & Matheson, C. C. (1992). Contextual constraints on the concordance of mother-child and teacher-child relationships. *New Directions for Child Development*, 57, 25-40.
- Howes, C., & Ritchie, S. (1999). Attachment organizations in children with difficult life circumstances. *Development and Psychopathology*, 11, 251–268.
- Howes, C., & Smith, E. (1995). Relations among child care quality, teacher behavior, children’s play activities, emotional security, and cognitive activity in child care. *Early Childhood Research Quarterly*, 10, 381–404.
- Howes, C., Hamilton, C. E., & Matheson, C. C. (1994). Children’s relationships with peers: Differential associations with aspects of the teacher-child relationship. *Child Development*, 65, 253-263.
- Howes, C., Phillipsen, L.C., & Peisner-Feinberg, E. (2000). The consistency of perceived teacher-child relationships between preschool and kindergarten. *Journal of School Psychology*, 38 (2), 113-132.
- Howes, C., Rodning, C., Galluzzo, D. C., & Myers, L. (1990). Attachment and child care: Relationships with mother and caregiver. In N. Fox & G. G. Fein (Eds.), *Infant day care: The current debate (pp.169-182)*. Norwood, NJ: Ablex.
- Jacobsen, T., & Hofmann, V. (1997). Children’s attachment representations: Longitudinal relations to school behavior and academic competency in middle childhood and adolescence. *Developmental Psychology*, 33, 703–710.
- Jacobsen, T., Edelstein, W., & Hofmann, V. (1994). A longitudinal study of the relation between attachment representations in childhood and cognitive functioning in childhood and adolescence. *Developmental Psychology*, 30, 112-124.
- Krstic, K. (2012). School learning and student-teacher attachment. Patchwork. Learning diversities, Belgrade, 30.08. - 1.09. 2012. Conference proceedings: full papers, pp. 164-172. http://www2.unine.ch/files/content/sites/patchworks2012/files/CONFERENCE_PROCEEDINGS.pdf

- Larose, S., Bernier, A., & Tarabulsky, G. (2005). Attachment state of mind, learning dispositions, and academic performance during the college transition. *Developmental Psychology*, 41(1), 281–289.
- Lourdasamy, A., & Swe Khine, M. (2001, December). *Self-evaluation of interpersonal behavior and classroom interaction by teacher trainees*. Paper presented at The International Education Research Conference, University of Notre Dame, Fremantle Western Australia. Retrieved May 25, 2015. from The Australian Association for Research in Education: <http://www.aare.edu.au/01pap/atp01465.htm>
- Lynch, M., & Cicchetti, D. (1992). Maltreated children's reports of relatedness to their teachers. *New Directions for Child Development*, 57, 81-108.
- Main, M., & Cassidy, J. (1988). Categories of response to reunion with the parent at age six: Predictable from infant attachment classifications and stable over a 1-month period. *Developmental Psychology*, 24, 415-526.
- Marchant, G. J., Paulson, S. E., & Rothlisberg, B. A. (2001). Relations of middle school students perceptions of family and school context with academic achievement. *Psychology in the Schools*, 38(6), 505-519.
- Moss, E. & St-Laurent, D. (2001) Attachment at School Age and Academic Performance. *Developmental Psychology Vol. 37, No. 6*, 863-874.
- Muller, C., Katz, S. R., & Dance, L. J. (1999). Investing in teaching and learning. Dynamics of the teacher-student relationship from each actor's perspective. *Urban Education*, 34, 292–337.
- Murdock, T. B. (1999). The social context of risk: Status and motivational predictors of alienation in middle school. *Journal of Educational Psychology*, 91, 62–75.
- Murray, C. & Greenberg, M.T. (2000). Children's relationships with teachers and bonds with school: An investigation of patterns and correlates in middle childhood. *Journal of School Psychology*, 38 (5), 423-445.
- O'Connor, E., & McCartney, K. (2007). Attachment and cognitive skills: An investigation of mediating mechanisms. *Journal of Applied Developmental Psychology*, 28, 458–476.
- O'Donnell, J., Hawkins, J. D., & Abbott, R. D. (1995). Predicting serious delinquency and substance use among aggressive boys. *Journal of Consulting and Clinical Psychology*, 63(4), 529-537.
- Parish, M. (2000). The nature of the patient's tie to the therapist (Doctoral dissertation, Adelphi University, 1999). Dissertation Abstracts International, 60, 6378-B.
- Parish, M. and Eagle, M.N. (2003). Attachment to the therapist. *Psychoanalytic Psychology Vol. 20, No. 2*, 271–286.
- Pekrun, R. (2000). A social cognitive, control-value theory of achievement emotions. In J. Heckhausen (Ed.), *Motivational psychology of human development*. Oxford, UK: Elsevier.
- Pekrun, R. (2005). Progress and open problems in educational emotion research. *Learning and Instruction*, 15, 497–506.
- Pianta, R. C. (1999). *Enhancing relationships between children and teachers*. Washington, DC: American Psychological Association.
- Pianta, R. C., & Harbers, K. (1996). Observing mother and child behavior in a problem-solving situation at school entry: Relations with academic achievement. *Journal of School Psychology*, 67, 307–322.
- Pianta, R. C., & Nimetz, S. (1991). Relationship between children and teachers: Associations with classroom and home behavior. *Journal of Applied Developmental Psychology*, 12, 379–393.

- Pianta, R.C. The Student Teacher Relationship Scale; Professional Manual. Retrieved February 21, 2014. from http://curry.virginia.edu/uploads/resourceLibrary/STRS_Professional_Manual.pdf
- Pianta, R. C., Belsky, J., Vandergrift, N., Houts, R. M., & Morrison, F. J. (2008). Classroom effects on children's achievement trajectories in elementary school. *American Educational Research Journal*, 45 (2), 365–397.
- Pianta, R. C., LaParo, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS) Manual*, Pre-K. Baltimore, MD: Brookes Publishing.
- Pianta, R. C., Nimetz, S. L., & Bennett, E. (1997). Mother-child relationships, teacher-child relationships, and school outcomes in preschool and kindergarten. *Early Childhood Research Quarterly*, 12, 263–280.
- Pianta, R. C., Steinberg, M. S., & Rollins, K. (1995). The first two years of school: Teacher-child relationships and deflections in children's classroom adjustment. *Development & Psychopathology*, 7, 295–312.
- Pianta, R. C., Steinberg, M. S., & Rollins, K. B. (1995). The first two years of school: teacher-child relationships and deflections in children's classroom adjustment. *Development and Psychopathology*, 7, 295–312.
- Pianta, R.C. & La Paro, K. (2003). Improving early school success. *Educational Leadership*, April, 24-29.
- Popović Ćitić, B. (2012). Vežanost za školu kod učenika koji imaju različite uloge u vršnjačkom nasilju. *Specijalna edukacija i rehabilitacija*, vol. 11, br. 4. 547-564.
- Radišić, J. & Baucal, A. (2012). Understanding practice of mathematics and language teachers from their own perspective, paper presented at the 25th International Congress for School Effectiveness and Improvement, Malmo 5th-8th January 2012. http://www.icsei.net/fileadmin/ICSEI/icsei_2012/papers/1791918_ABS.pdf
- Reddy, R., Rhodes, J. E., & Mulhall, P. (2003). The influence of teacher support on student adjustment in the middle school years: A latent growth curve study. *Development and Psychopathology*, 15, 119–138.
- Rudasill, K.M & Rimm-Kaufman, S.E. (2009) Teacher-child relationship quality: The roles of child temperament and teacher-child interactions. *Early Childhood Research Quarterly* (24), 107–120.
- Rychen, D.S. & Salganik, L.H. (2003). *Key Competencies for a Successful Life and Well-Functioning Society*. Hogrefe & Huber, USA.
- Sakiz, G., Pape, S.J., & Woolfolk Hoy, A. (2012) Does perceived teacher affective support matter for middle school students in mathematics classrooms? *Journal of School Psychology* 50 (2012) 235–255.
- Simons-Morton, B. G, Crump, A. D., Haynie, D. L., & Saylor, K. E. (1999). Student-school bonding and adolescent problem behavior. *Health Education Research*, 14(1), 99-107.
- Spieker, S. J., Nelson, D. C., Petras, A., Jolley, A., & Barnard, C. (2003). Joint influence of child care and infant attachment security for cognitive and language outcomes of low-income toddlers. *Infant Behavior & Development*, 26, 326-344.
- Stievenart, M., Roskam, I., Meunier, J.C., & van de Moortele, G. (2011) The reciprocal relation between children's attachment representations and their cognitive ability. *International Journal of Behavioral Development* 35(1) 58–66.
- Stipek, D., Salmon, J. M., Givvin, K. B., Kazemi, E., Saxe, G., & MacGyvers, V. L. (1998). The value (and convergence) of practices suggested by motivation research and promoted by mathematics education reformers. *Journal for Research in Mathematics Education*, 29, 465–488.
- Teo, A., Carlson, E., Mathieu, P., Egeland, B., & Sroufe, L.A. (1996). A prospective longitudinal study of psychosocial predictors of achievement. *Journal of School Psychology*, 34, 285-306.

- Thompson, R. (2008). Early Attachment and Later Development: familiar questions, new answers; In J. Cassidy & P. Shaver (Eds.). *Handbook of Attachment: Theory, Research and Clinical Application*, (pp. 348-365). New York: The Guilford Press.
- Tucker, C. M., Zayco, R. A., Herman, K. C., Reinke, W. M., Trujillo, M., Carraway, K., et al. (2002). Teacher and child variables as predictors of academic engagement among low-income African American children. *Psychology in the Schools*, 39, 477–488.
- Valiente, C., Lemery-Chalfant, K., Swanson, J., & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology*, 100, 67–77.
- Van IJzendoorn, M. H., & Vliet-Visser, S. (1988). The relationship between quality of attachment in infancy and IQ in kindergarten. *Journal of Genetic Psychology*, 149, 23-28.
- Van IJzendoorn, M. H., Sagi, A., & Lambermon, M. W. E. (1992). The multiple caretaker paradox: Data from Holland and Israel. In R. C. Pianta (Ed.), *Beyond the parent: The role of other adults in children's lives. New directions for child development*, Vol. 57 (pp. 5–24). San Francisco: Jossey-Bass.
- Van IJzendoorn, M., Dijkstra, J., & Bus, A. (1995). Attachment, intelligence, and language: A meta-analysis. *Social Development*, 4, 115-128.
- Videnović, M. & Radišić, J. (2011). Anksioznost u vezi sa učenjem matematike: Matematika - bauk ili ne? *Psihološka istraživanja*, Vol. 14. str.157-177.
- Walberg, H.J. (1981). A psychological theory of educational productivity. In F. Farley & N.J. Gordon (Eds.), *Psychology and education: the state of the union* (pp. 81–108). Berkeley, CA: McCutchan.
- Weinfield, N. S., Sroufe, A., Egeland, B., & Carlson, E. (1999). The nature of individual differences in infant-caregiver attachment. In J. Cassidy & P. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 68–88). New York: Guilford.
- Weinfield, N. S., Sroufe, L. A., Egeland, B., & Carlson, E. (2008). Individual differences in infant-caregiver attachment: conceptual and empirical aspects of security. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, Research and Clinical Application (2nd ed.)*. (pp. 78-101) New York: Guilford.
- Wentzel, K. R. (1997). Student motivation in middle school: The role of perceived pedagogical caring. *Journal of Educational Psychology*, 89(3), 411–419.
- Wubbels, T. & Brekelmans, M. (2005) Two decades of research on teacher–student relationships in class. *International Journal of Educational Research* (43), 6–24.
- Wubbels, Th., & Levy, J. (1991). A comparison of interpersonal behavior of Dutch and American teachers. *International Journal of Intercultural Relations*, 15, 1-18.
- Wubbels, Th., & Levy, J. (Eds.). (1993). *Do you know what you look like: Interpersonal relationships in education*. London, England: Falmer Press.
- Wubbels, Th., Creton, H. A., & Hooymayers, H. E (1992). Review of research on teacher communication styles with use of the Leary model. *Journal of Classroom Interaction*, 27, 1-12.
- Zeidner, M. (1998). *Test anxiety. The state of the art*. New York: Plenum.
- TIMSS (2011). TIMSS and PIRLS 2011: Relationships Among Reading, Mathematics and Science Achievement at the Fourth Grade – Implications for Early Learning. Retrieved October 6., 2014. from <http://timss>.

bc.edu/timsspirals2011/downloads/TP11_Relationship_Report.pdf & Instruction to Engage Students in Learning Scale. Retrieved October 6., 2014. from http://timss.bc.edu/methods/pdf/T11_G4_G_Scales_IES.pdf

- PISA (2012). Technical Report. Retrieved October 6., 2014. from <http://www.oecd.org/pisa/pisaproducts/PISA-2012-technical-report-final.pdf>

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Традиционална струја истраживања у психологији образовања фокусирана је на изучавање когнитивних аспеката учења, наставе и интеракције ученика и наставника. Све већи број истраживања указује да су социоемоционално добростање ученика у школи и квалитет интеракције ученик-наставник суштински значајни за прилагођавање школи, учење и школско постигнуће. У овом раду бавимо се значајем социоемоционалног односа ученика и наставника из перспективе теорије везивања. Основна идеја овог истраживања јесте да везаност ученика за наставника, као основа њихове социоемоционалне интеракције, може поспешити учење и развој.

Белики број истраживања је показао да подржавајућа и топла интеракција са наставником може имати утицај на учење, социјалне компетенције и прилагођавање школи. Наставник може бити „сигурна база“ за истраживање и учење у школи, пружајући исту емоционалну сигурност и подршку које карактеришу и сензитивно и респонзивно родитељство. Студије су показале да сигурна везаност за родитеље има значајне импликације за развој когнитивних способности, бољу школску прилагођеност, виша школска постигнућа, развијеније социјалне компетенције. На сличан начин и сигурна везаност за наставника повезана је са вишим школским постигнућем, позитивнијим ставовима према школи, већим залагањем и учешћем у активностима на часу и ређим понављањем разреда.

У истраживањима о улози емоција у образовању доминирају истраживања која су фокусирана на значај појединих емоција (на пример, испитна анксиозност) или на ученичке или наставничке емоције и њихову функцију и утицај на когнитивне процесе, наставу и учење. Истраживања која се баве интеракцијом најчешће испитују педагошку интеракцију наставника и ученика и начине на које ученици стичу знања и вештине током те интеракције. Нову струју истраживања у образовању чине студије које се баве микроанализом процеса интеракције и специфичним поступцима ученика и наставника. Оно што недостаје су истраживања фокусирана на емоционални однос и интеракцију ученика и наставника. Тај емоционални однос је релативно стабилан и трајан фактор који утиче не само на динамику односа и интеракција ученика и наставника већ и на процес наставе и учења.

Основни циљ овог истраживања јесте да утврди како су емоционални квалитет интеракције наставника и ученика, специфични однос везаности и карактеристике наставничке праксе повезани са два важна образовна исхода: школским успехом и позитивним односом ученика према школи и учењу.

Рад је усмерен на истраживање ученичке интеракције и везаности за учитељицу на крају четвртог, односно наставника математике на крају седмог разреда основне школе. Истраживањем је обухваћено триста шездесет шест ученика из пет београдских основних школа. За потребе овог истраживања упитник је конструисан адаптацијом неколико постојећих скала којима се мере различите димензије односа ученик–наставник. Упитником су обухваћене следеће димензије: димензије социоемоционалног односа наставника и ученика – тражење близине, посебност, протест због одвајања, уточиште, сигурна база (димензије везаности), отворена комуникација и блискост; димензије наставничке праксе – педагошка подршка, вођство, захтевност, помоћ/ пријатељски однос, задовољство, конфликтност. Као меру образовног постигнућа узели смо ученички позитиван однос према школи и учењу и оцене из српског језика, математике и просечну оцену на крају претходног разреда.

Анализа поузданости скала показала је да две скале (захтевност и вођство) имају ниску поузданост, због чега су искључене из даљих анализа. Факторском анализом утврђено је да се димензије социоемоционалног односа групишу око једног фактора који је назван везаност за наставника. Димензије наставничке праксе: помоћ/ пријатељски однос, задовољство и конфликтност такође чине један фактор, назван позитиван емоционални однос према ученицима. Ове димензије, уз димензије педагошка подршка и позитиван однос према школи и учењу, и школске оцене биле су основа за SEM анализу (structural equation modeling) на подзорцима ученика четвртог и седмог разреда.

У теоријском моделу претпостављено је да везаност за наставника утиче на школске оцене и позитиван однос према школи и учењу, а да наставничка педагошка подршка и позитиван емоционални однос са ученицима утичу на везаност за наставника, али и директно на оба образовна постигнућа. SEM анализом утврђено је да, на оба узраста, теоријски модел одговара емпиријски добијеним подацима, али и да постоје везе међу варијаблима/димензијама које нису значајне.

На узорку ученика четвртог разреда утврђено је да везаност за учитељицу утиче и на позитиван однос према школи и учењу и на школске оцене. С друге стране, везаност за учитељицу зависи од обе димензије наставничке праксе – од педагошке подршке и позитивног емоционалног односа према ученицима. Истовремено, педагошка подршка утиче и директно на школске оцене, док позитиван емоционални однос са ученицима утиче на њихов општи однос према школи и учењу. Осим тога, ове две димензије наставничке праксе су повезане, што значи да ученици опажају да учитељица која има позитивнији емоционални однос са њима даје и квалитетнију педагошку подршку.

На узрасту ученика седмог разреда везаност за наставника математике утиче само на позитиван однос ученика према школи и учењу, али не и на оцене из математике. Везаност за наставника математике зависи само од наставничког позитивног емоционалног односа према ученицима, не и од квалитета педагошке подршке коју пружа. На оцене из математике утичу и квалитет педагошке подршке коју наставник пружа, али и позитиван емоционални однос према ученицима. Осим тога, на овом узрасту нема међусобне везе између ове две димензије наставничке праксе.

На основу ових резултата, може се закључити да на оба узраста постоји везаност ученика за учитељицу, односно наставника математике и да та везаност утиче на један од образовних исхода, позитиван однос према школи и учењу. На млађем узрасту учитељица је важна као фигура везаности и топао, сигуран, подржавајући однос са учитељицом повољно утиче и на школско постигнуће мерено оценама ученика. Ученици ће развити сигурну везаност за учитељицу која има позитиван емоционални однос са ученицима, што значи да је пријатељски расположена, помаже им, задовољна је својим ученицима и ретко је са њима у сукобу; и истовремено пружа квалитетну педагошку подршку

и фидбек. На старијем узрасту, везаност за наставника математике имаће утицај само на генерални позитиван однос према школи и учењу. На овом узрасту ученици имају мање потреба, али, имајући у виду да се ради о предметном наставнику, и мање прилика да развију однос везаности са једним предметним наставником. Оно што одређује њихов успех из математике, су позитиван емоционални однос наставника и квалитет педагошке подршке.

Утицај везаности за наставника на образовне исходе, утврђен у овом истраживању, указује на значај успостављања позитивног емоционалног односа у учионици и развијања топлог, сензитивног и подржавајућег окружења за учење у школи.

Кључне речи: везаност за наставника, педагошка подршка, емоционални однос, образовна постигнућа.



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The Role of Asymmetrical Interaction in the Assessment of Nonverbal Abilities of Children from the Drop-in Center

Abstract: *The aim of this article is to show how a differently organized testing procedure can lead to a better understanding of intellectual capacity in children who live or work in the streets. The study presented in it tried to answer the following questions: 1) Does the achievement of children from the Drop-in center improve significantly on a nonverbal intelligence test when solved together with the experimenter? 2) Which type of scaffolding is most effective for children's task solving - affective-motivational, visual cognitive or verbal cognitive? 3) Which features of the asymmetric interactions enable children to find a solution to the tasks that they previously failed to solve? The sample consisted of 30 children from the Belgrade Drop-in center. Initially, the Kohs block design test was administered independently to children, and if they failed to solve it, the experimenter would provide scaffolding gradually, as listed above. The results showed that the children's achievement was very low when doing the test independently, but improved significantly when solving the tasks in interaction. According to cluster analysis four groups of children were identified which served as basis for the qualitative analysis. The conversational analysis between the children and the experimenter showed what proved to be the most significant difference between the groups, which is the function of affective-motivational help with task solving. It also demonstrated that the affective-motivational aid was a part of every successful interaction, but usually needed to be combined with its cognitive variants. As these results suggest, the standardized testing procedures need to be adapted so as to make sure that the children understand the demands of the tasks and that they are motivated and supported to reach the goal of the interaction. Only then can we obtain more valid information about the cognitive capacities of the children from the Drop-in center.*

Key words: *children from the Drop-in center, Kohs block test, asymmetrical interaction, cognitive assessment, dynamic assessment.*

Introduction

Cognitive assessment tests are commonly standardized on a population of children that make up the majority and the middle class in a given environment (Tovilović & Baucal, 2007; Maltby et al., 2007). They consist of a determined number of predefined correct answers and their aim is to gather information about the child's current achievement. Due to these characteristics, such testing procedures result in an unfair stratification based on gender, race, socioeconomic status and cultural differences (Tovilović & Baucal, 2007). Children coming from minority cultures and disadvantaged communities and children less familiar with the test language are often unacquainted with those predefined answers, since they do not share the experience of the majority-culture children (Tovilović & Baucal, 2007). Therefore, the adequate assessment of marginalized children's achievement represents a major challenge.

Due to the need for increased validity of cognitive assessments, an alternative method called *dynamic assessment* was developed. The dynamic assessment measures learning processes directly during the testing procedure instead of doing it indirectly, based on the results of the past learning experiences (Sternberg, 2002; Sternberg, 2005). The main goal of this method is to gather information not only on the current, but also on the child's potential achievement (Haywood & Lidz, 2007), while its main role is to detect the specific barriers to an individual's effective learning, as well as the ways in which these barriers can be overcome (Tzuriel, 2000; Haywood & Lidz, 2007).

Dynamic assessment is based on socio-cultural theories and the notion of the zone of proximal development (ZPD) introduced by Vygotsky (1977). The information about the respondent's abilities obtained by standard testing procedures represents the current level of their achievement, or in other words - what the child can do independently (zone of actual development - ZAD). Dynamic assessment, on the other hand, reveals what the child

can achieve with the help of a more competent partner. It therefore involves a more competent partner who encourages the child to solve the tasks he failed to solve independently by suggesting correct strategies. Specifically, the more competent person applies *scaffolding* - a type of support that allows the child to solve the problem by focusing only on those elements of the task he is able to solve with the skills it already possesses, while the more competent partner controls the components of the task that exceed the child's current abilities (Wood et al., 1976). Thus provided aid enables the child to solve the task by acting within its zone of proximal development (Vygotsky, 1977). Scaffolding can be applied in different ways: by simplifying the task, motivating the child, focusing the child's attention to certain aspects of the task, putting the task in a context more familiar to the child, using language that is understandable to children or by using technical tools to make various activities easier. An example of this type of scaffolding can be providing a tutor that solves the task (Wood et al., 1976), or a tutor focusing the child's attention to the structure of the task while constantly providing feedback on the current performance (Fernandez et al., 2001).

It is considered that dynamic assessment can help overcome the obstacles that arise in a test designed without taking into account the cultural characteristics of the marginalized children's socio-cultural context (Tovilović & Baucal, 2007). These obstacles are being overcome more easily with the help of dynamic assessment since it provides marginalized children with a better understanding of the demands they are facing during the course of cognitive assessment.

Socio-cultural theories suggest that learning and development in children within various domains (cognitive, social, emotional, etc.) are influenced by their socio-cultural environment and the expectations of their community about the roles that its members are supposed to take in the life of that community. Different communities have dif-

ferent socialization goals and make different cognitive demands on children (Fuller & Garcia Coll, 2010) which could explain the difference between acquired competencies and word meanings in children from marginalized groups and those in children from the majority of the population.

Studies show that dynamic assessment usually enables marginalized children to improve their achievement significantly by allowing them to solve tasks in asymmetrical interaction (hereinafter: AI). A study by Stenberg and Grigorenko (Stenberg & Grigorenko, 2002) analyzed test approaches based on the notion of the zone of proximal development and showed that children from culturally and educationally deprived environments improved significantly when solving tasks in AI compared to their achievement when solving tasks independently. Similar data were obtained in a research involving preschoolers with low TIP1 test achievement since they also improved significantly during dynamic assessment (Luković, 2011; Luković et al., 2013). Its analysis showed that the preschoolers involved in the research came from poor families and communities, that they were not enrolled in a preschool program and that their parents did not have the capacity to provide conditions which would meet developmental needs of their children.

A study conducted in Netherlands compared the achievement of children from the majority of the population with that of children coming from ethnic minorities, both belonging to the same age group (7-9 years old). It compared their achievement on a seriation test and their improvement after the dynamic assessment (Resing et al., 2009). The results showed that the children from the majority of the population were more successful when solving the task independently, that both groups improved their achievement as a result of graduated scaffolding, but that the children from ethnic minorities significantly improved their achievement compared to their pre-test one (Resing et al., 2009).

A study conducted in Australia (Chaffey et al., 2003) tried to find a better method of identifying gifted Aboriginal children, since they usually underperformed on standardized tests regardless of their abilities. Aboriginal students were tested with Raven's Progressive Matrices in order to determine whether dynamic assessment was an adequate method of identifying gifted children. On average, the children's pre-test achievement was significantly below the average for their age group. After the dynamic testing however, the children in the experimental group showed significant improvement in solving the tasks compared to the results of their initial attempt, but also to the ones in the control group. The authors concluded that dynamic assessment gave them a more valid insight into the development, the abilities and the giftedness of the Aboriginal children (Chaffey et al., 2003).

As the described studies show, children who come from different cultures or from deprived environments show significantly higher levels of achievement when engaged in cognitive task solving within AI than when solving tasks independently. However, these studies have not explored the content of the interaction and the support necessary for allowing marginalized children to express the potentials that they fail to express independently.

Scope of the study

The scope of this study was to analyze how a differently organized test situation, or more precisely dynamic assessment, may provide a better understanding of the intellectual capacities in a specific group of marginalized children. It focuses on the children from the Belgrade Drop-in center for children living or working in the streets. In particular, it tried to give an answer to the following questions:

- Does the achievement of children from the Drop-in center improve significantly on a nonverbal intelligence test when solved together with the experimenter? The as-

sumption that the respondents will improve significantly in cooperation with the experimenter is based on the findings that children from socially disadvantaged backgrounds often have a wide ZPD (Chaffey et al., 2003; Sternberg & Grigorenko, 2002; Resing et al. 2009; Luković, 2011; Luković et al., 2013).

- What types of scaffolding influences children most effectively when solving the tasks that they fail to solve independently? Given that the findings of a study (Baucal, 2003) focused on children from the majority of the population showed that affective-motivational scaffolding has proved as sufficient for a significant number of children to solve the tasks that they previously failed to solve within a standard testing procedure, it seemed useful to explore whether the children from the Drop-in center would improve their achievement significantly with the same type of scaffolding.
- Because we do not have any findings about this population it would be interesting to see which features of the asymmetric interaction allows children to find a solution to the tasks that they fail to solve independently?

Method

Sample

The sample consisted of 30 children, 16 girls and 14 boys, from 10 to 14 years old ($M = 11.4$, $SD = 1.4$). All of the children used the services of the Belgrade Drop-in center for children who live and/or work in the streets. They lived in informal settlements, came from large families affected by extreme poverty and declared themselves as members of the Roma community. The children's families supported themselves by collecting secondary raw materials, by working in the flea market, or by work-

ing part-time physical labor jobs. All of the children participating in the study worked on the streets (occasionally or regularly), or had done so until recently. Their activities consisted of helping their families in the above mentioned activities or begging. These children were exposed to many risks and to specific challenges that encouraged them to develop different competencies from the ones "typical" for a child of their age. Most of them suffered from educational deprivation to some extent.

The participants were diverse in terms of educational status - two girls completed an adult education program and a total of thirteen children went to school regularly at the time. Out of those thirteen only seven were enrolled in a regular elementary school, while the rest of them were enrolled in schools for adult education. The remaining fifteen children did not attend school at all, or attended it irregularly and ten out of these fifteen have not completed the first grade at the time.

Instrument

The instrument used for measuring children's intellectual capacities was the Kohs block design test - a subtest from the Revised Wechsler Intelligence Scale for Children (Biro, 1987). This instrument has been chosen because it is a non-verbal test and it is therefore assumed to be less influenced by the children's specific socio-cultural experiences (a "culture free" test - Aptekar 1989, Biro et al., 2006). It was important to administer precisely such a test considering that the population of children we chose as our sample and the ones from the majority of the population differed in mother tongue and in cultural background.

The Kohs block design test requires that the respondents replicate patterns displayed on two-dimensional models by using different colour blocks. It consists of four demonstrations and eight tasks. The first five tasks are solved with four blocks, and the last three with nine blocks. The tasks are arranged by complexity, from simpler to the more

complex ones and the original procedure requires a limited time frame for completion of each task.

Procedure

Based on the findings of the pilot study and for the purpose of this study the following changes were made in the testing procedure of the Kohs block design test:

- The testing began with the first demonstration, regardless of the participants' age, so as to enable them to familiarize themselves with the test, understand the task solving principles and gain confidence by solving easier examples.
- Considering that the children manifested signs of distress when facing the time limitation for task completion, it was removed from the procedure. The experimenter would display the next task when it became apparent that the child has applied all the strategies that it could think of, without producing the required result.

During the testing procedure the evaluation of the child's responses was done instantly by the experimenter, and if the child failed to solve two consecutive tasks, the experimenter would stop the standard testing procedure and display the unsolved tasks again but this time providing scaffolding to the child. The affective-motivational scaffolding would be provided first – the experimenter would ask the child to think again about the possible solution and encourage it by expressing confidence in its abilities to succeed. If this kind of scaffolding did not help the child solve the task, the experimenter would move on to the first step of the cognitive scaffolding. This time the child would be presented with the same pattern to be replicated, but with borders of the blocks drawn on the pattern. If this kind of scaffolding did not help the child either, the experimenter would move on to the second step of the cognitive scaffolding which consisted in a verbal explanation of the strategy that was previously suggested visu-

ally. The experimenter would then provide a higher level of scaffolding for each task if it became apparent that the child has applied all the strategies that it could think of using the available scaffolding, and still failed to solve the task. After performing the above mentioned intervention, the experimenter would present another task that the child previously failed to solve and provide scaffolding for it as previously described. If the child failed to solve two consecutive tasks despite the scaffolding provided by the experimenter, the procedure would be stopped.

The cognitive scaffolding was provided in a pre-defined manner - the first step (visual aid) was meant to help the child understand that the pattern should be broken down into units (blocks) and then reconstructed by manipulating those units so that they replicate the pattern. The second step (verbal aid) had the task of suggesting the same strategy, only verbally.

With the children's permission and their parents' consent the testing procedure was recorded with a video camera and it lasted around 19 minutes on average. Subjects solved most of the tasks within the time limitations given in the test guidelines. An interesting finding however, is the significant difference in the time it took for the same respondents to solve different tasks, regardless of their difficulty. A possible explanation might be found in the problems with maintaining attention that some of the children encountered while performing the tasks. The recorded material is transcribed according to the Jefferson system of transcription (Jefferson, 2004) and its symbols are explained in the Appendix 1.

RESULTS

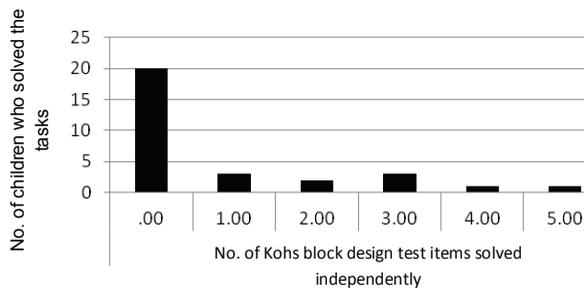
Quantitative analysis

Children's individual baseline achievement

The average number of individually solved tasks was the following: $M = 0.83$, $SD = 1.41$ (in the

value range of 0 - 8). Twenty respondents failed to solve any of the tasks in the test (Graph 1) and none of the participants managed to solve the entire test.

In order to be able to compare the achievement in children from the sample with the average achievement in children from the majority of the population that belong to the same age group, it was necessary to consider the standardized test scores. Average score of our sample was $M = 2.46$; $SD = 2.20$ (in the value range 1-19), while the average achievement of children from the majority of the population is in the range of 8-12 points (Biro, 1987). This data shows that the children in our sample achieved a lower average score than the one in the sample used for the test standardization.



Graph 1 – Distribution of the test scores when children solved tasks independently

Children’s achievement with scaffolding

As we can see from the Table 1, children solved additional 0.53 tasks on average when provided with affective-motivational scaffolding, while they solved one additional task on average with visual type of cognitive scaffolding, and additional 0.96

tasks more on average with the highest level of scaffolding.

The improvement accomplished after each type of scaffolding, that we see in the Table 1, is not statistically significant. Overall however, the children solved about 2.5 additional tasks within the AI (about 31% of the entire test) after being provided with all types of scaffolding, which is three times higher than their independent achievement and therefore it represents a statistically significant difference $t(29) = - 5.73$; $p = .00$.

After being provided with different types of scaffolding, 20% of the children in the sample solved the entire test and a total of 77% of them managed to improve the overall achievement within the AI.

In addition, we wanted to analyze if the respondents’ average achievement within AI managed to reach the one in children from the majority of the population. One third of the children from our sample achieved a score of 10.7 points on average, which corresponds to 104 IQ points, while one of the girls even achieved an above-average score of 14 points, an equivalent to 129 IQ points!

Qualitative analysis

Qualitative analysis of AI was used to explain the ways in which children found solutions to the tasks after being provided with scaffolding. The basis of the qualitative analysis was the hierarchical cluster analysis (Ward’s method with squared Euclidean Distance as a measure of distance or similarity was applied) which divided the children into 4 groups based on the similarity of their achievements

Table 1. Achievement of children when solving tasks independently and with different kinds of scaffolding

	Independent solving	Affective -motivational scaffolding	1st level of cognitive scaffolding	2nd level of cognitive scaffolding
M of solved tasks	0.83	+ 0.53 (SD= .89)	+ 1.00 (SD=1.70)	+ 0.96 (SD=1.29)
M of solved tasks independently+scaffolding		1.36	2,36	3.32

and improvements within the interaction. Conversation analysis of each cluster helped determine that the groups of children differ in the way they use affective-motivational scaffolding in the interaction with the experimenter.

First cluster – children who improved with all three types of scaffolding

First cluster consisted of children (N = 7) with a better achievement in solving tasks independently compared to the other groups. They also improved significantly when provided with any of the three types of scaffolding. These are the children with a relatively high ZAD, relatively low abilities that manifest only upon the encouragement and support of a more competent partner (in the form of motivational scaffolding) and a high ZPD, considering the significant improvement they displayed in the interaction.

These children were provided with the motivational scaffolding mostly in order to reduce the insecurity they showed during independent testing. The more competent partner motivated the children to keep working on the solution by confirming to them regularly that they made the right step towards the solution and by reassuring them that they had the ability to master the task.

The section below represents a part of a conversation that took place between the experimenter and a girl named Marijana² (14). It illustrates the part where the experimenter is providing the child with the affective-motivational scaffolding and therefore the way in which the children from this group used this type of aid to improve their achievement.

Excerpt 1

1. **Exp.:** and now this picture? (1.0)
also [with all of these blocks] (2.0)
a sada ova sličica? (1.0) isto od [svih ovih kockica] (2.0)
2. **Marijana:** [oh::: teacher]
[iju::: nastavnice]
3. **Exp.:** c'mon try (2.0) try see how you've solved nicely all of it so far (6.0)
ajde probaj (2.0) pokušaj vidiš kako si sve fino rešila do sada (6.0)
4. **Marijana:** this is really hard
ovo je stvarno teško
5. **Exp.:** hm?
m?
6. **Marijana:** this is really hard (1.0)
ovo je stvarno teško (1.0)
7. **Exp.:** well right c'mon try (.) it's not a big deal (1.0) you did all of it m: arranged them right (.) first six of them (2.0) [you understand all of it well]
pa dobro ajde pokušaj (.) nije to ništa strašno (1.0) sve si se m: lepo složila (.) svih prvih šest ovih (2.0) [sve ti to lepo razumeš]
8. **Marijana:** [well it's really hard] (4.0) ((arranging blocks))
[pa stvarno teško] (4.0) ((slaže kocke))
9. **Exp.:** mhm
mhm
10. **Marijana:** hm?
hm?
11. **Exp.:** good (.) let's move on? (2.0)
dobro (.) ajmo dalje? (2.0)
12. **Marijana:** is it like this (2.0)
jel ovako (2.0)
13. **Exp.:** you are looking for this picture (1.0) so you are looking for a way to make it like this (25.0)
tražiš ovu sličicu (1.0) znači gledaš kako da napraviš ovo što je (25.0)

² The names of all the children mentioned in the study are not real and have been replaced in order to protect the anonymity of the participants.

14. Marijana: ((turns blocks, moves them around, but makes no progress in terms of completing the pattern)) i don't know if it's like this (6.0) ((still turns and moves the blocks around, forms a part of the pattern))
((okreće kocke, premešta ih, ali ne napreduje u formiranju figure))
ne znam jel tako (6.0) ((i dalje okreće i premešta kocke, formira jedan deo tražene figure))
15. Exp.: mhm (6.0)
mhm (6.0)
16. Marijana: no (23.0) ((takes the blocks one by one and checks every side to see if it fits in the reproduced part of the pattern)) it's not like this (9.0) it's not like this right (1.0)
ne (23.0) ((uzima po jednu kocku i isprobava svaku stranicu da li se uklapa u složeni deo figure)) nije ovako (9.0) nije ovo ovako jel tako (1.0)
17. Exp.: here look at the picture and it should look the same (44.0)
evo gledaš na slici pa treba da ti ispadne tako isto (44.0)
18. Marijana: ((takes the blocks one by one and checks which one fits in the reproduced part of the pattern)) ah:: wait no (3.0) i did this good ((looks at the experimenter for confirmation))
((uzima po jednu kocku i isprobava koja stranica se uklapa u složeni deo figure)) ja::o čekaj ne (3.0) ovo sam dobro uradila ((pogledom traži potvrdu od ispitivača))
19. Exp.: mhm you see it looks the same as in the picture yes
mhm vidiš da je kao i na sličici da
20. Marijana: this is already: (1.0) this angle right (2.0) ha?
ovo je već: (1.0) ovaj ćošak jel tako (2.0) a?
21. Exp.: come on you look (3.0) how it should be done from there on (37.0)
hajde gledaš (3.0) kako bi to trebalo dalje (37.0)
22. Marijana: ((apparently without a clear plan, she takes blocks one by one and checks every side to see if it fits into the reproduced part of the pattern)) oh man (6.0) i don't know which one goes here (2.0) i don't know[how]
((naizgled bez jasne ideje isprobava različite strane kocaka kako se uklapaju u deo figure koji je složila)) au je (6.0) ne znam šta ide (2.0) ne znam [kako]
23. Exp.: well you started off great there is not much left come on (9.0)
pa odlično si počela nije ti još puno ostalo a:jde (9.0)

We can see from the Excerpt 1 that the girl was expressing insecurity from the very beginning, arguing that the task was hard (turns 2, 4, 6 and 8) before she even tried to solve it. She attempted to solve the task only after the experimenter expressed his confidence in her ability to master the task by pointing out the fact that she solved all of the previous ones successfully (turn 7). Also, for the most part of the conversation the girl was asking for the experimenter's confirmation about the accuracy of the reproduced part of the pattern, which can be seen in turns 10, 12, 16, 18, 20. The experimenter kept referring her to her own judgment and the comparison between the reproduced pattern and the one on the model (turns 13, 17, 19, 21). In turn 22 Marijana says openly that she doesn't know how to solve the task, but when she receives the necessary positive evaluation of her answer by the experimenter (turn 23), she makes progress in the task completion.

Based on the analysis of the interaction between Marijana and the experimenter, we may conclude that the motivational scaffolding served as a "support system" for the girl throughout the tasks

solving process – she arrived to the solution step by step, by asking confirmation for her competencies from the experimenter and by checking with him the accuracy of every step in the process.

Second cluster – children who didn't manage to improve with scaffolding

The second cluster consisted of children (N = 11) with low achievement when solving tasks on their own, that barely improved when provided with any kind of scaffolding. Therefore, these children have a low ZAD, low abilities that may be manifested with the encouragement by a more competent partner (in the form of motivational scaffolding), and also a low ZPD because they did not manage to improve even when provided with the cognitive scaffolding.

These children were provided with motivational scaffolding mostly in order to confirm the accuracy of each step they made towards the solution and maintain their motivation throughout the task solving process. They had difficulty understanding the tasks, the strategies suggested by the experimenter, and the context of the assessment process. Therefore, a confirmation of their answers' accuracy was perhaps the only way for them to check whether they are doing what they were asked by the experimenter.

The Excerpt 2 contains a transcript of the conversation that took place while providing verbal type of cognitive scaffolding to a girl named Katarina (11) for the easiest task in the test. She, like most of the children in this cluster, managed to slightly improve her achievement only with the combination of cognitive and affective-motivational scaffolding.

Excerpt 2

1. **Exp.:** so you look at each of those blocks (1.0) and find a side like this one and place it (.) then like this one and place it (.) then

like this one and this one and place it? (.) and like this one and place it. ((points with finger each of the marked sides on the model, and then each block)) (2.0) that's the way you put blocks

znači gledaš svaku ovu (1.0) i nađeš takvu stranicu i staviš (.) pa nađeš ovako pa staviš (.) pa ovako pa staviš? (.) i ovako pa staviš. ((svaku obeleženu stranicu na modelu pokazuje prstom pa zatim pokazuje na po jednu kocku)) (2.0) sve tako stavljáš kockice

2. **Katarina:** ((observes and turns blocks, joins two together)) like this=

((posmatra i okreće kocke, spaja dve)) ovako=

3. **Exp.:** =mhm good (5.0)
=mhm dobro (5.0)

4. **Katarina:** ((turns one block and puts it in the right place)) like this

((okreće jednu kocku i stavlja je na pravo mesto)) ovako

5. **Exp.:** ((nodes)) yes great (1.0) and (2.0) the last one(4.0)

((klima glavom)) jeste odlično (1.0) i (2.0) ova poslednja (4.0)

6. **Katarina:** ((turns the last block and puts it in the right place))

((okreće poslednju kocku i stavlja je na mesto))

7. **Exp.:** well done kaća (1.0) you see (.) great (.) good?

bravo kaća (1.0) evo vidiš (.) odlično (.) dobro?

The Excerpt 2 shows us that an explanation of the strategy and a visual presentation on the model itself together with a non-verbal explanation of the model's connection to the blocks (turn 1) were the methods that helped the girl understand and apply the presented strategy (turn 2). However, due to the

fact that Katarina wasn't certain whether she understood the task's requests, she needed a constant confirmation that she was on the right path, and therefore she continued to check the accuracy of every answer with the experimenter (turns 2 and 4).

Third cluster – children who improved with cognitive scaffolding

The third group of children (N = 3) singled out by cluster analysis managed to improve only when provided with the cognitive scaffolding – they had a low initial achievement, did not improve with the motivational scaffolding, but improved significantly with both types of cognitive scaffolding. It seems that this group of children has a low ZAD, low abilities that are manifested when the child is encouraged (in the form of motivational scaffolding) and a high ZPD.

Using conversation analysis, we concluded that the motivational scaffolding in this group focused on maintaining the children's attention and structuring the process of task solving. However, on its own, it was not enough for children to improve their achievement because of their initial wrong approach to the task.

The Excerpt 3 represents a conversation conducted while providing visual type of cognitive scaffolding to Marko (10). It illustrates how the children from this cluster used motivational scaffolding to improve their achievement.

Excerpt 3

1. **Exp.:** all right? (1.0) and if we now display (2.0) this picture? (.) instead of this one?=*((moves the card with the pattern and places a card containing the visual type of cognitive scaffolding in front of Marko))*
dobro? (1.0) a ako sad damo (2.0) ovu sličicu? (.) umesto ove?=(sklanja karticu s modelom i stavlja ispred

Marka karticu koja sadrži vizuelnu kognitivnu pomoć))

2. **Marko:** =no no leave them both
=ne ne pusti obadve tu
3. **Exp.:** ((smiling)) well [ok that] is the same thing, there is just with one extra thing drawn
((osmehuje se)) pa [dobro to] ti je to isto samo je dodatno ovo nacrtano
4. **Marko:** [doesn't matter]=
[nema veze]=
5. **Exp.:** =c'mon how would you do it if you had this? (1.0) does it then help you find which blocks you [should]
=ajde pogledaj kako bi to ovde kad imaš ovo? (1.0) da li ti onda pomaže da razmisliš koje kockice tu [treba]
6. **Marko:** [i know] teacher=
[znam] nastavnice=
7. **Exp.:** =c'mon try (1.0)
=ajde da probaš (1.0)
8. **Marko:** ((arranges blocks one by one in an orderly manner)) like this (3.0)
((ređa jednu po jednu kocku redom)) ovo vako (3.0)
9. **Exp.:** good? (1.0) and where do these other two go (3.0)
dobro? (1.0) i kako idu ove druge dve (3.0)
10. **Marko:** ((puts one more block in place))
((stavlja još jednu kocku na pravo mesto))
11. **Exp.:** like that (.) great? and how will the last one go (3.0)
tako (.) odlično? I poslednja kako će (3.0)
12. **Marko:** ((puts the last block in place))
((stavlja poslednju kocku na pravo mesto))
13. **Exp.:** well done you see there are enough blocks (.) mhm? (1.0)

excellent (1.0) great (1.0) all right?

*bravo eto vidiš da ima (.) mhm?
(1.0) super (1.0) odlično (1.0)
dobro?*

The previous passage showed us that the boy did not improve when provided with visual type of cognitive scaffolding because in turn 2 he asked the experimenter to leave both cards on the table – the one with the pattern and the other with borders of the blocks drawn on the pattern. The explanation which the experimenter then provided (turn 3), that the patterns on the cards are the same, and that the second card contains only an additional drawing encouraged the boy to focus on the additional drawing and realize that he needed to think of the pattern as a set of 4 blocks. This kind of conclusion was drawn due to the boy's confirmation in turn 6 that he understood how the task should be approached, and because shortly after he began to look for the appropriate sides of the blocks and reproduced the pattern accurately (turn 8). In turn 8 the boy asked for confirmation, and once the examiner had given it to him, he was motivated to continue (turn 9). A similar dynamic continued to play out in subsequent turns (10, 11 and 12), until Marko made an exact reproduction of the pattern. In turn 13 the experimenter pointed out to the boy that he was indeed given all the necessary blocks to reproduce the pattern because of the boy's previous claim that both blocks were necessary for solving the same task when he was provided with solely motivational scaffolding.

The conversation analysis showed that the motivational scaffolding had a purpose of encouraging a careful observation and analysis of the visually suggested strategy. It also provided the boy with the necessary support to continue working on the solution confirming that he was adequately using the suggested strategy. In addition, this form of scaffolding partially structured the task solving process by motivating Marko to move on to the next step ("Good, and where do these other two go?").

Fourth cluster – children who improved only with the highest level of scaffolding

Fourth group of children (N = 9) managed to improve their achievement only when provided with the highest level of scaffolding – they had an extremely low initial achievement and significantly improved only with the verbal type of cognitive scaffolding. These children have a very low ZAD, low abilities that are manifested only with encouragement within AI (in the form of motivational scaffolding) and a relatively wide ZPD because most of them significantly improve their achievement when provided with scaffolding compared to their initial attempt of solving the tasks independently.

The motivational scaffolding provided to this group of children was mostly focused on motivating them to continue to work on the solution and on directing their attention to the details, because they had difficulty understanding the goal of the task which was to reproduce the displayed pattern and not just to place blocks next to each other with a particular side facing up.

The Excerpt 4 represents the conversation that took place between the experimenter and Jasna (12) while providing her with the highest level of scaffolding. It illustrates the manner in which the children from this cluster used the motivational scaffolding in interaction with the experimenter.

Excerpt 4

1. **Exp.:** **mhm so check carefully if every one of these is placed exactly as you placed them (1.0) each of these sides (.) like the one here, on the blocks ((points with a finger to the marked sides of the blocks on the pattern, and then to the blocks in front of the participant)) (18.0)**

mhm znači svaka ova lepo proveriš da li je potpuno isto nameštena kao kod tebe (1.0) svaka ova stranica (.) kao jedna ovde na kockicama ((prstom

pokazuje na obeležene stranice na modelu, pa na ispitanicine kocke)) (18.0)

2. **Jasna:** here
evo
3. **Exp.:** hm? let's check this one to see if it is [is it] placed properly ((points on one marked side of the block on the pattern))
hm? ajde da proverimo ova da vidimo kako je ona [jel ona kako] treba nameštena ((pokazuje na jednu obeleženu stranicu na modelu))
4. **Jasna:**
[here it i:s] (2.0)
[evo je tu:] (2.0)
5. **Exp.:** [hm]?
[hm]?
6. **Jasna:** [m:]well it's the same
[m:]pa ista
7. **Exp.:** all right, this side?
dobro ova stranica?
8. **Jasna:** here (2.0) ah:: no. ((takes the block whose orientation was wrong and tries to rotate it to find the right orientation))
evo (2.0) a:: ne. ((uzima kocku čija je orijentacija pogrešna i pokušava da je okrene pravilno))
9. **Exp.:** aha (.) what should be done here (2.0)
aha (.) šta treba da se napravi (2.0)
10. **Jasna:** like this ((places the block properly)) (1.0)
tako ((stavlja kocku na pravo mesto)) (1.0)
11. **Exp.:** like tha::t(.) we:ll done (.) you see that it's all good now ta::ko (.) bra:vo (.) vidiš da je sad sve dobro

In the Excerpt 4 we saw that the suggested strategy was made clearer to Jasna by connecting the particular sides marked on the pattern to their appearance on the blocks (turn 1) in order for her to understand the requirements of the task - it wasn't

enough to turn the blocks with the right side up, but she also had to rotate them correctly so as to reproduce the right pattern. The experimenter then tried to structure the task solving process (turn 3) by suggesting to Jasna to check each of the marked sides on the pattern against the corresponding sides on the blocks in order for her to notice the difference, and this strategy led to the desired result (turn 8).

The conversation analysis showed that the Jasna's initial understanding of the task was only to some extent correct (because she observed the displayed model as a set of 4 elements), as she did not realize that the purpose of the elements was to create a certain pattern. The motivational scaffolding in this group focused on motivating the children to continue to work on a solution and on directing their attention to details so that they would realize it is necessary to compare the pattern's reproduced part with the one on the model.

Discussion

The participants have achieved a significantly lower score when solving tasks independently compared to the norms determined through the instrument's standardization within the majority of the population. This finding did not come as a surprise, given that the evaluation of the participants' achievement was done based on standards that are not entirely adequate for them. Considering the experiences specific to the children from the Drop-in center, who are living in a different culture and in poverty, it is safe to assume that they have developed competencies relevant to such living conditions (Biro et al., 2006). Therefore, they possess less incentives for developing skills assessed by the test as opposed to the children from the majority of the population. Also, given that the half of the children dropped out of school or attend it irregularly, they are likely to have had fewer opportunities to develop competencies for successful test solving such as problem-solving skills or maintaining focus (Biro et

al., 2006). The assessed children haven't had the opportunity to develop these skills at home either, because of their unfavorable living conditions.

However, the analysis of the children's achievement after solving tasks within the AI showed different results. They made a significant improvement and achieved on average a result that was three times higher than the one from their first independent attempt. This kind of finding was also expected and in line with the previous studies on the improvement of children from disadvantaged backgrounds within AI (Sternberg & Grigorenko, 2002; Luković, 2011; Luković et al., 2013; Chaffey et al., 2003). In addition, the quantitative analysis did not single out one type of scaffolding that had the most significant influence on the children's improvement. It showed that only once all types of scaffolding were provided, the improvement was significant. On the other hand, during the qualitative analysis, motivational scaffolding revealed to be an integral part of almost every successful interaction, but usually in combination with cognitive scaffolding. Motivational scaffolding had an important role in problem-solving process in all groups of children, but its role was somewhat different for each group. In other words, these findings suggest that motivational and cognitive aspects of social interaction may have different relations and roles between them. They also highlight the importance of including different combinations of motivational and cognitive scaffolding when working with marginalized children allowing them that way to develop more easily within their own potential.

For some children, the motivational scaffolding had a role in helping them overcome their insecurities and providing them with further support throughout the task solving process. They received a confirmation from the experimenter when they reproduced a part of the pattern correctly and when they chose the right task solving strategy. Additionally, it served as a reminder to children that they should carefully check their answers. The described method was also used in combination with cognitive types of

scaffolding. This group of children has not had difficulties understanding the tasks and proposed strategies, and often already had the necessary competencies for solving them, but they were just not manifested when the children tried to solve the tasks independently. This kind of relation between motivational and cognitive scaffolding gave results in children who had the highest educational status in the sample.

However, some children needed a different kind of support. In their case, the motivational scaffolding was mostly focused on verifying the accuracy of the steps made in the task solving process and maintaining their motivation to solve the task. Due to the fact that these children were confused by the task demands, the motivational scaffolding was a way for them to find out if they were headed in the right direction. These were the children with the lowest educational status in the sample, and it seemed that their lack of understanding of the tasks and the task solving principles was due to their lack of experience with similar problems. Since the testing situation represented a relatively unfamiliar situation for them, whose meaning and goal they had difficulty understanding, one of the main objectives of motivational scaffolding with them was maintaining their motivation to continue working on the task's solution.

There were some children that needed help primarily in maintaining attention and structuring the task solving process. In this case, only the visual type of cognitive scaffolding showed as effective. These children also had difficulty understanding the tasks and requirements that were placed on them. However, quickly after being provided with the visual type of cognitive scaffolding they realized the right task solving strategy and applied it. After failing to implement the same strategy in the following tasks based on their previous experience, these children quickly realized that they needed cognitive scaffolding and asked for it while being provided with motivational scaffolding. It is also possible that these children realized that task solving was easier with cognitive scaffolding and therefore were not able to make a greater cognitive ef-

fort and solve the tasks without it due to their lack of attention and focus. The fact that they lack focus is additionally confirmed by the role that the motivational scaffolding had for them - it was directed towards motivating them to continue the task solving process and turning their focus on the key aspects of the displayed pattern.

Finally, some children required motivational scaffolding in the form of motivation for moving forward towards the solution. They also needed to have their attention drawn to the details and directed towards comparing the reproduced part of the pattern with the displayed model. Once provided with that kind of scaffolding in combination with the verbal type of cognitive scaffolding, they were able to achieve the goal of the interaction. These children also have a low educational status, so it is not surprising that they also had difficulty understanding the assessment situation. However, they had a clear idea of how to group the blocks, the only thing they failed to realize is that the blocks should be grouped into a pattern, not just put together with the right side up. We can therefore assume that this kind of reasoning is also a consequence of the children's lack of experience with similar materials and problems, and that is why they failed to understand the part of the meaning which was "implied" (that the displayed pattern should be reproduced).

Conclusion

As shown in the results, the children from the Drop-in center achieve low scores in standard testing procedures, regardless of their actual cognitive abilities. Practitioners who work with such marginalized groups of children should bear this in mind and carefully draw conclusions about their abilities when performing this kind of assessment.

Also, our findings have confirmed that children improve their achievement significantly within

AI, but that it is impossible to single out one type of scaffolding that enables them to do so. It is necessary to combine different types of scaffolding in order for children to improve. Although motivational scaffolding proved to be a vital part of all interactions that resulted in success, it usually had to be combined with cognitive types of scaffolding. In addition, children used it in different ways and also different ways of combining motivational and cognitive scaffolding produced results with different children. Therefore, in order to obtain more accurate information about the cognitive capacities of marginalized children, it is necessary to adapt the standardized testing procedures so as to make sure that the children understand the demands of the tasks and that they possess the necessary motivation and support to achieve the goal of the interaction.

These conclusions stress the importance of providing motivational scaffolding to marginalized children during cognitive assessment and teaching. Even when presented with the problem solving strategy, there is a possibility that these children do not reach the goal unless an adjusted kind of motivational scaffolding is included in the presentation. This approach can be applied to the children from the Drop-in center by providing them with the necessary support for developing their cognitive abilities through the work of pedagogical assistants who would be in charge of this task.

A careful analysis of the participants' achievement, improvement and background information led us to the conclusion that the children who attend school regularly and show a greater independent achievement, also show a greater ability for improvement with a more competent partner. However, the question that remains unanswered by this study is what type of scaffolding would enable improvement of the children who rarely have the opportunity to interact with the tasks and materials similar to those in the cognitive assessment tests.

References

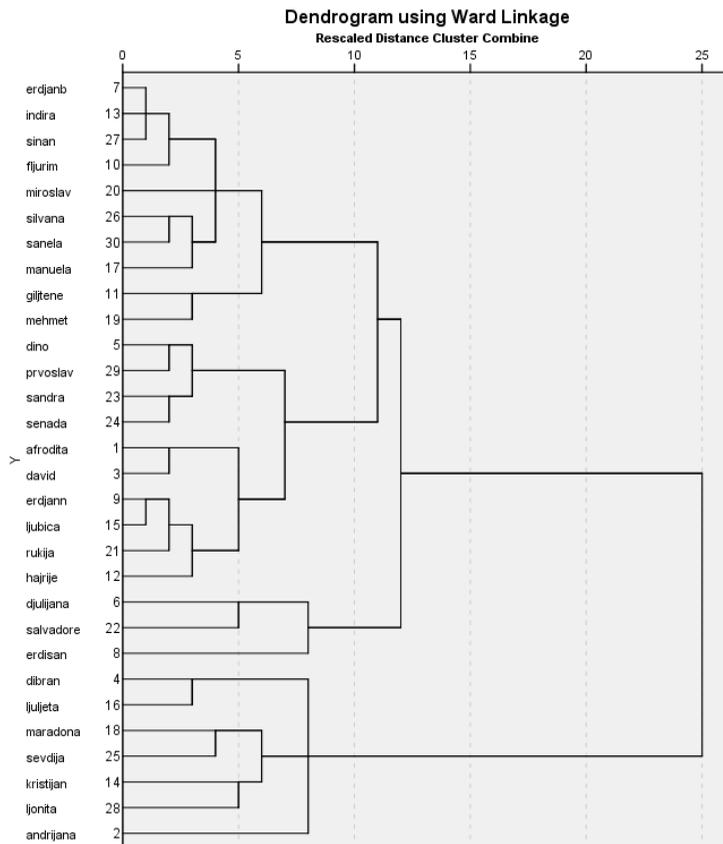
- Aptekar, L. (1989). Characteristics of the Street Children of Colombia. *Child Abuse & Neglect*, 13, 427-437.
- Baucal, A. (2003). Konstrukcija i ko-konstrukcija u zoni narednog razvoja: Da li i Pijaže i Vigotski mogu biti u pravu? *Psihologija*, 36(4), 517-542.
- Biro, M. (1987). *Priručnik za REVISK - Revidirana skala za merenje inteligencije po principima Vekslera*. Beograd: Savez društava psihologa Srbije.
- Biro, M., Novović, Z. i Tovilović, S. (2006). Kognitivno funkcionisanje edukativno zapuštene dece predškolskog uzrasta. *Psihologija*, 39 (2), 183-206
- Chaffey, G.W., Bailey, S.B. & Vine, K.W. (2003). Identifying High Academic Potential in Australian Aboriginal Children Using Dynamic Testing. *Australasian Journal of Gifted Education*, 12 (1), 42-55.
- Fernandez, M., Wegerif, R., Mercer, N., Rojas-Drummond, S. (2001). Re-conceptualizing "Scaffolding" and the Zone of Proximal Development in the Context of Symmetrical Collaborative Learning. *Journal of Classroom Interaction* 36 (2), 40-54.
- Fuller, B & Garcia Coll, C. (2010). Learning From Latinos: Contexts, Families, and Child Development in Motion. *Developmental Psychology*, 46(3), 559-565.
- Haywood, C.H. & Lidz, C.S. (2007). *Dynamic Assessment in Practice – Clinical and Educational Applications*. New York: Cambridge University Press.
- Howe, C. & Mercer, N. (2007). *Children's Social Development, Peer Interaction and Classroom learning*. Cambridge: University of Cambridge Faculty of Education.
- Jefferson, G. (2004). Glossary of transcripts symbols with an introduction. U (Ed. Lerner, G. H.) *Conversation Analysis: Studies from the first generation*. Amsterdam: John Benjamins Publishing Company.
- Luković, S. (2011). *Merenje zone narednog razvoja u predškolskom testiranju: TIP-1 kao instrument za dinamičko procenjivanje*. Master rad. Univerzitet u Beogradu, Filozofski fakultet.
- Luković, S., Baucal, A. i Tišma, B. (2013). Dinamičko procenjivanje zone narednog razvoja testom za ispitivanje prvaka-1 (TIP-1). *Primenjena psihologija*, 6(4), 371-383.
- Maltby, J., Day, L. & Macaskill, A. (2007). *Personality, Individual Differences and Intelligence*. Harlow: Prentice Hall.
- Resing, W.C.M., Tunteler, E., de Joung, F.M. & Bosma, T. (2009). Dynamic testing in indigenous and ethnic minority children. *Learning and Individual Differences*, 19 (4), 445-450.
- Sternberg, R. J. (2005). The Theory of Successful Intelligence. *Interamerican Journal of Psychology*, 39 (2), 189-202.
- Sternberg, R. J., Grigorenko, E. L. (2002). *Dynamic testing: The Nature and Measurement of Learning Potential*. Cambridge: Cambridge University Press.
- Tovilović, S. i Baucal, A. (2007). *Procena zrelosti za školu: Kako pristupiti problemima procene zrelosti i adaptacije marginalizovane dece na školu?* Beograd: Centar za primenjenu psihologiju Društva psihologa Srbije.
- Tzuriel, D. (2000). Dynamic Assessment of Young Children: Educational and Intervention Perspectives. *Educational Psychology Review*, 12(4), 385-435.
- Vygotsky, L. S. (1977). *Mišljenje i govor*. Beograd: Nolit.
- Wood, D., Bruner, J.S. & Ross, G. (1976). The Role of Tutoring in Problem Solving. *Journal of Child Psychology and Psychiatry*, 17 (2), 89-100.

APPENDIX

Appendix 1 – Symbols used in transcription (Jefferson, 2004)

- [Marks the start of turn overlap
-] Marks where turn overlap ends
- = Marks concatenation of two turns
- (.) Marks a pause of about 1/10 of a second
- (1.0) Marks a pause whose length is marked in seconds
- . Marks intonation declining
- ? Marks intonation increase
- ((abc)) Marks additional descriptions of the transcriber
- _ Marks an accentuated syllable or part of a word
- : Marks an extended voice

Appendix 2 – Cluster analysis – dendrogram



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Улога асиметричне интеракције у процени невербалних способности деце из Свратишта

Когнитивна процена деце из маргинализованих средина често је отежана због културолошких разлика које се јављају између нормираног и испитиваног узорка, затим због препрека које носи низак социоекономски статус испитиване деце, њихова едукативна депривација, али и језичких баријера које се јављају приликом тестирања. Управо ради потребе да се повећа информативност когнитивних процена и код деце из маргинализованих средина, развило се динамичко процењивање, које подразумева добијање информација о актуелном, али и о потенцијалном постигнућу детета.

У овом истраживању желели смо да боље разумемо интелектуалне капацитете и специфичности корисника београдског Свратишта за децу која живе или раде на улици. Конкретно, циљ истраживања био је усмерен ка тражењу одговора на следећа питања: 1) Да ли се постигнуће деце из Свратишта на невербалном тесту интелигенције значајно повећава када га решавају у асиметричној интеракцији са испитивачем; 2) Која врста помоћи је најчешће била потребна деци да ураде задатке које нису могли самостално – афективно-мотивациона помоћ, визуелна или вербална варијанта когнитивне помоћи; 3) На који начин су деца у оквиру датих помоћи дошла до решења за која претходно нису имала неопходне когнитивне структуре или нису успела да их употребе да би дошла до решења?

У истраживању је учествовало тридесеторо деце, корисника Свратишта за децу који живе у неформалним насељима, потичу из многочланих, екстремно сиромашних породица и изјашњавају се као припадници ромске заједнице. Највећи број њих одликује васпитно-едукативна депривација.

Невербалне когнитивне способности деце мерене су тестом Косове коцке – суптестом у РЕВИСК тесту. Задатак сваког детета био је да прво покуша самостално да склопи коцке и тек у случају неуспеха испитивач је пружао прво афективно-мотивациону помоћ – сугерисао је детету да размисли поново и храбрио га тиме да он верује да дете сигурно може да реши тај задатак. Уколико уз овај ниво помоћи дете не би успело да реши задатак, испитивач је прелазио на први корак когнитивног нивоа помоћи (визуелна когнитивна помоћ), у ком се детету давао модел са исцртаним границама коцака. Ако ни уз овај ниво помоћи дете не би успело да реши задатак, испитивач је прелазио на други корак когнитивног нивоа помоћи, који је обухватао вербално представљање стратегије која је претходно визуелно сугерисана. Након овог нивоа помоћи испитивач је прелазио на следећи задатак који дете није успешно решило у самосталном покушају. Сва испитивања су снимана видео-камером, уз претходно одобрење сваког детета и сагласност родитеља.

Добијени резултати показују да су у оквиру самосталног решавања деца постизала значајно ниже скорове у односу на норме које су настале на основу стандардизације инструмента у општој популацији. Овај налаз је очекиван, с обзиром на то да су постигнућа деце процењивана на основу нормативне групе која није референтна за испитивану популацију. Међутим, испитивана деца су у асиметричној интеракцији показала значајно напредовање. На основу добијених квантитативних података нисмо били у могућности да издвојимо једну помоћ која је највише допринела напретку, али нам је у томе помогла квалитативна анализа интеракција испитивача и деце. Као полазна основа за квалитативну анализу послужила нам је кластер анализа, којом су издвојене четири групе деце. Ова анализа је показала да је афективно-мотивациона помоћ била саставни део сваке успешне интеракције, с тим што су се кластери разликовали према томе коју је функцију имала афективно-мотивациона помоћ при решавању теста у асиметричној интеракцији.

Добијени резултати сугеришу да је за добијање тачније информације о когнитивним капацитетима деце Свратишта неопходно напустити оквире стандардне тестовне процедуре како би им била обезбеђена могућност за боље разумевање захтева који су пред њима, као и мотивација и подршка неопходни за постизање циља интеракције.

Кључне речи: деца из Свратишта, Косове коцке, асиметрична интеракција, тестирање когнитивних способности, динамичко тестирање.

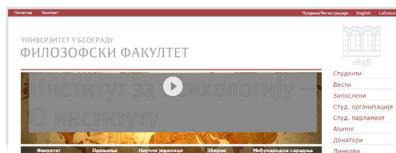
КОРИСНЕ ВЕБ ЛОКАЦИЈЕ

Институт за психологију
<http://www.f.bg.ac.rs/instituti/IPS/>

Институт за психологију је научна јединица Филозофског факултета у Београду. Бави се фундаменталним и примењеним истраживањима из области психологије, као и развојем научног кадра Републике Србије. Основали су га 1961. године Извршно веће НР Србије, Филозофско-историјски факултет и Медицински факултет у Београду. Први директор Института био је професор др Никола Рот, а први председник Савета Института професор др Борислав Стевановић.

Приликом оснивања Института пред њега су постављена два задатка: да ради на истраживању и решавању проблема у области психологије и да помогне стручно и научно усавршавање научног подмлатка, односно организовање наставе трећег степена. Мада у самој организацији наставе није директно учествовао, Институт је помогао великом броју будућих магистара и доктора наука да изведу своја истраживања и дођу до неопходних података за своју тезу. Данас је тешко замислити развој пси-

хологије у Србији без Института за психологију, с обзиром на везу која постоји између стручног и научног развоја већине значајних имена у области психологије на овом простору, с једне, и развоја и рада Института за психологију, с друге стране. Институт је издавач и часописа *Психолошка исцртавања*. Посебан део издавачке делатности чине и зборници са научних скупова чији је Институт био организатор или суорганизатор.

**Друштво психолога Србије**
<http://www.dps.org.rs/pocetna>

Друштво психолога Србије је 1992. године основало Центар за примењену психологију као самостално предузеће за истраживачко-развојне услуге, графичко-издавачку делатност и комерцијалне послове. Центар се бави: 1) Издавачком делатношћу: уџбеници, приручници и друга психолошка литература; 2) Израдом и дистрибуцијом психолошких мерних ин-

струмената: тестова способности, инвентара личности и тест-апарата, као и пратеће стручне литературе; 3) Организацијом семинара: стручних усавршавања и обучавања из различитих области примењене психологије, за психологе и трећа лица (менаџери, директори, васпитачи, педагози); 4) Професионалном селекцијом; 5) Организацијом научностручног скупа психолога Србије; 6) Организацијом истраживачких пројеката; 7) Прибављањем и дистрибуцијом научностручних информација и другим пословима који су од интереса за психологе и ширу јавност.

**Социјална психологија**
<http://www.socialpsychology.org/>

На страницама највеће базе података на интернету из социјалне психологије (Social Psychology Network) налази се преко једанаест хиљада хипервеза које воде до значајних локација из ове области.



Музеј историје науке
<http://www.mhs.ox.ac.uk/about/>

Музеј историје науке у Оксфорду поседује значајну веб-локацију. Програмске активности Музеја реализују се кроз монографске и тематске изложбе, циклусе предавања из разних области науке, промоције књига и часописа, концерте, приређивање округлих столова и пројекције научнопопуларних филмова. Из прегледног менија ове локације можемо добити информације о предстојећим догађајима, посетити мрежне изложбе, базе, архивирану колекцију музејских билтена, као и библиотеку са преко осам хиљада слика.



Часопис Примењена психологија
<http://psihologija.ff.uns.ac.rs/primenjena/>

На датој локацији налази се научни часопис *Примењена психологија*. Часопис издаје Одсек за психологију Филозофског факултета Универзитета у Новом Саду.



Друштво истраживача у образовању у Србији
<http://www.dios.edu.rs/>

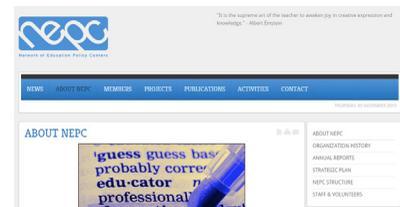
Удружење Друштво истраживача у образовању у Србији је добровољно, невладино и непрофитно удружење. Основи циљ Друштва је да повеже истраживаче у области образовања у Србији и подстакне успешну научноистраживачку сарадњу унутар ове области. Такође, Друштво ће активно радити на повезивању чланова Друштва са међународним организацијама у области образовања, уз подстицање рада и сарадње истраживача из Србије са колегама из области образовања у европским и међународним круговима. Циљ Друштва је и да активно повезује истраживаче у области образовања у Србији са креаторима образовне политике и подстиче сарадњу ради делотворног одлучивања.



Мрежа центара за образовне политике
<http://www.edupolicy.net/>

Мрежа центара за образовне политике (енг. Network of Education Policy Centers –NEPC) јесте међународно невладино удружење организација посвећених

развоју образовних политика. Мисија NEPC-а је ојачавање локалне и регионалне експертизе у функцији партиципаторне и истраживачки утемељене образовне политике и промоција вредности отвореног друштва у образовању на међународном нивоу. NEPC је основан 2006. године као формална мрежа центара за образовне политике, али је заправо започео са радом раније. NEPC је настао од неформалне групе људи који су делили заједничке вредности утемељене у уверењу да је образовна промена кључ сваке друштвене промене и залог боље будућности за све. Мрежа је отада еволуирала кроз бројне развојне фазе у процесу коју садржи рефлексију, расправу, комуникацију, деловање, успехе и понекад неуспехе. Мрежа тренутно има у чланству двадесет три институције из шеснаест земаља, међу којима је и Србија, као и четири индивидуална члана. На сајту Мреже можемо се упознати са актуелним пројектима, активностима и значајним публикацијама, које можемо преузети у електронском облику.



Центар за образовне политике
<http://www.cep.edu.rs/>

Центар за образовне политике (ЦОП) је независни мултидисциплинарни истраживачки центар који пружа стручну подршку доносиоцима одлука и практича-

рима у развоју, примени и евалуацији политика у области образовања. Притом, ЦОП стално настоји да препозна и укаже на области којима, како доносиоци одлука, тако и научна заједница треба да се баве, притом снажно се залажући за информисање образовних политика и пракси доказима произведених кроз рад у друштвеним наукама. Осим стално запослених, ЦОП има и велику мрежу сарадника из различитих делова региона и шире.



Часопис *Истраживање развоја деце на раном узрасту* <http://ecr.sagepub.com/>

Часопис *Истраживање развоја деце на раном узрасту* (енг. Journal of early childhood research) има посебан значај за истраживаче, креаторе образовне политике и практичаре који се баве развојем деце и васпитнообразовним радом.



Причајмо о томе <http://www.pricajmootome.rs/>

Пројекат „Причајмо о томе“ бави се пружањем бесплатне психолошке помоћи студентима кроз мрежно (енг. online) психолошко саветовање, путем електронске поште, скупова и форума. На сајту студенти могу добити помоћ од психотерапеута различитих терапијских праваца. У оквиру пројекта планирана је организација низа образовних предавања са различитим темама из области менталног здравља које имају за циљ разбијање предрасуда о тражењу психолошке помоћи, разбијање предрасуда о коришћењу интернета, информисање студента о могућностима употребе савремених средстава комуникације за заштиту и унапређење свог здравља и, најважније, подизање нивоа свести студената о значају и начинима бриге о менталном здрављу. Пројекат реализује невладина организација „Промена“.



Британска библиотека <http://www.bl.uk/>

Британска библиотека садржи тринаест милиона књига, преко деветсто двадесет хиљада часописа и новина, али и преко три милиона звучних записа. Овај линк свакако треба додати у листу омиљених локација. Сигурно ћете пронаћи нешто што досад нисте могли да нађете ни на једном дру-

гом месту. Библиотека располаже са преко девет милиона чланака из преко двадесет хиљада часописа.



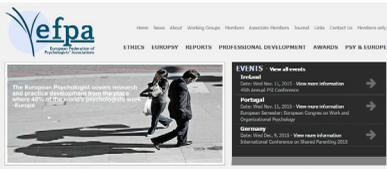
Америчка психолошка асоцијација <http://www.apa.org/>

Америчка психолошка асоцијација је водећа научна и професионална психолошка организација у САД. Њена основна мисија је да примени знања из психологије како би се унапредио живот људи.



Европска федерација психолошких асоцијација <http://www.efpa.eu/>

Европска федерација психолошких асоцијација (енг. European Federation of Psychologists' Associations – EFPA) јесте водећа федерација националних психолошких асоцијација. Она обезбеђује форум за европску сарадњу на пољима академске обуке, психолошке праксе и истраживања. Тренутно је тридесет и шест европских земаља у чланству EFPA, и представљају их око триста хиљада психолога. Друштво психолога Србије примљено је у редове ове Европске федерације 2007. године у Пра-

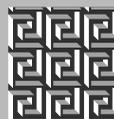


гу. Организација земаља-чланица се бави промоцијом и унапређи-

вањем психологије као професије и као научне дисциплине, у примењеним областима, са нагласком на обуци и истраживањима повезаних са тим областима у пракси. Психолози у земљама-чланицама су, како практичари, тако и академски психолози и истраживачи.

Један од циљева Федерације је повезивање праксе и истраживања у психологији, као и стварање интегративне психолошке дисциплине.

др Мирослава Ристић
Учитељски факултет, Београд



GENERAL INFORMATION

Teaching Innovations is a scientific periodical issued by the Teacher Education Faculty, University of Belgrade. It includes theoretical and systematic review papers and original research papers related to sciences and scientific disciplines dealing with the teaching process at all levels of pedagogical and educational work with the aim of its improvement and modernisation. *Teaching Innovations* is intended to provide support to researchers, and inspiration to practitioners to find optimal solutions and efficient strategies for introducing innovations in pre-school, primary, secondary and tertiary education, including life-long learning.

The periodical is issued quarterly.

PAPER SUBMISSION GUIDELINES

The following categories of scientific papers are published in the *Teaching Innovations* periodical:

1. Original scientific paper (reporting previously unpublished results of the author's original research based on the IMRAD (Introduction, Methods, Results and Discussion) scientific method scheme);
2. Systematic review (presenting original, detailed and critical review of the issue under study including the author's personal contribution, proved by self-citation);
3. Short scientific paper (original scientific paper which summarises the results of one's original research work or work that is still in progress);
4. Review paper (the known findings and results of original research are presented with the aim of spreading information and knowledge as well as their application in praxis).

Apart from scientific and review papers, the *Teaching Innovations* periodical publishes translations of papers, informative reviews and general reviews (of books, computer programmes, educational software, scientific events, etc.), as well as profession-related information.

Manuscripts should be sent by e-mail and are not returned. The electronic address of the editorial board is: inovacije@uf.bg.ac.rs. Papers can be submitted in Serbian, English, Russian or French. Papers positively assessed by the reviewers will be published in the Periodical in the language in which they were written. The authors who want their paper to be published in a foreign language (English, Russian or French), must have it translated into the language of their choice.

All papers are anonymously reviewed by two component reviewers. **The author is obliged to inform the editorial board in writing about any changes made in the text (number of the page which includes the changes with all the changes highlighted) according to the reviewers' comments and recommendations.** Upon that, the decision regarding publication is made, which the author is informed of within three months.

The paper submitted for publication should conform with the *Teaching Innovations* style sheet in order to be taken into consideration for reviewing. **Papers which do not comply with the outlined style sheet will be returned to the author (authors) for revision.**

STYLE SHEET

1. Font. The paper should be written in Microsoft Word, font Times New Roman size 12. Paragraphs: font – Normal, spacing – 1.5, the first line automatically indented. (Col 1)

2. Volume. The full volume of systematic reviews and original research articles is up to 16 pages (36 000 characters); short scientific papers, critiques, polemics and discussions, as well as review papers or translated papers up to 8 pages (about 15 000 characters); and event reports and short reviews up to 2 - 3 pages (about 3800-5600 characters). The editor has the right to accept longer papers if the research requirements are such.

3. General information about the authors. Name, middle name (initial only) and surname are given in the heading, affiliation in the line below. The third line should include home address or Institution address and the birth year (the birth year is not published, but it is used for paper classification at the National library of Serbia). The author's name should be accompanied with a footnote stating the author's e-mail address. If there are several authors, only one (preferably the first author's) address should be provided. If the paper is based on a doctoral thesis, the footnote should include the title of the thesis, place and faculty where the viva took place. Papers resulting from research projects should include the project title and registry number, the funding organisation and institution of its application. Position: left.

4. Title of the paper. Three lines below the name. Font: Times New Roman, 12, bold; position: centre.

5. Summary. It can be 150–300 words long, and should be given at the beginning of the paper, one line below the title. It should state the aim of the paper, applied research methods, the most significant results and conclusions. **The editorial board provides translation of the summaries into English or translation of extended summaries from other languages into Serbian.** The editorial board does not provide translations of full papers into foreign languages.

6. Key words. They are stated below the summary. There should be up to five words in *italics*, in standard letters, separated by a comma (with a full stop behind the last one).

7. The text body. Papers should be written concisely, in a comprehensible style and in a logical order. As a rule, it includes the introductory part with a clearly stated aim or the main problem of the paper, description of methodology, presentation and discussion of the results, and a conclusion with suggestions for further research or praxis.

8. References in the text. Literature used is referred to in brackets and included in the body of the text, not in a footnote. Surnames of foreign authors used in the text body are quoted in the original form or are phonetically transcribed in Serbian, accompanied by the original in brackets with the year of publishing

included. For example: Mejer (Meyer, 1987). If the paper was written by two authors, surnames of both are stated; in the case of more than two authors, the surname of the first author is stated, followed by “et al.”

9. Citations. No matter how long, the citation should be followed by a reference to the page number.

10. Tables, graphs, schemas, pictures. Tables and graphs should be in Word or a similar compatible programme. Each table, graph or schema must be comprehensible without reading the text, i.e. it must be marked with an ordinal number, title and caption (not longer than one line) and the legend (explanation of marks, codes and abbreviations). Pictures should be prepared in the electronic form in the 300dpi resolution and jpg format. Tables, graphs, schemas and pictures should be inserted in proper places in the text. Showing the same data in table and graph formats is unacceptable. Illustrations taken from other sources (books, journals) must be quoted with the source. Apart from that, a written consent from the copyright owner should be obtained and submitted to the editorial office.

11. Statistical analysis results. Results of statistical interpretations should be presented in the following way: $F=25.35$, $df=1,9$, $p < .001$ or $F(1,9)=25,35$, $p < .001$ (as common in the statistics of pedagogical and psychological research).

12. Footnotes and abbreviations. Not allowed, except in special cases.

13. List of references. The end of the text should be followed by a list of references quoted in the text, in alphabetical order and in the following way:

BOOK

Sahlberg, P. (2011). *Finnish Lessons. What can the world learn from educational change in Finland?* New York: Teacher College Press, Teachers College, Columbia University.

PAPER IN A PERIODICAL

Haslam, A. A., Jetten, J., Postmes, T. and Haslam, C. (2009). Social Identity, Health and Well-Being: An Emerging Agenda for Applied Psychology. *Applied Psychology*, 58 (1), 1-23.

CHAPTER IN A BOOK or REVIEW IN A BOOK OF PROCEEDINGS

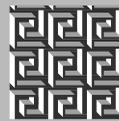
Zgaga, P., Devjak, T., Vogrinc, J. and Repac I. (2001). National report - Slovenia. In: Zgaga, P. (ed.). *The Prospect of Teacher Education in South-east Europe (527–570)*. Ljubljana: University of Ljubljana, Faculty of Education.

WEB DOCUMENTS

Kallestad, J. and Olweus, D. (2003). Predicting Teachers and Schools Implementation of the Olweus Bullying Prevention Program: A Multilevel Study. *Prevention and Treatment*, Vol. 6, No. 2. Retrieved May 18, 2000. from www: <http://www.vanguard.edu/psychology/apa.pdf>.

The reference list should only include references cited in the text body or those analysed in a review paper.

When the same author is cited several times, this should be done following the sequence of years in which the papers were published. If several cited papers were written by the same author and published in the same year, references should be marked by letters next to the year of issuance, for example 1999a, 1999b... Citing unpublished works should be avoided.



Часопис *Иновације у настави* научни је часопис који издаје Учитељски факултет Универзитета у Београду. У њему објављујемо теоријске, прегледне и оригиналне истраживачке радове из наука и научних дисциплина које третирају наставни процес на свим нивоима васпитања и образовања у циљу његовог унапређења и модернизације. Циљ је да *Иновације* буду подршка истраживачима, а инспирација практичарима у проналажењу оптималних решења и ефикасних стратегија за увођење иновација у настави од предшколског васпитања преко основношколске, средњошколске и универзитетске наставе до целоживотног образовања.

Часопис излази четири пута годишње.

УПУТСТВО АУТОРИМА

У часопису *Иновације у настави* објављујемо научне чланке који припадају следећим категоријама:

1. изворни научни чланак (у коме се износе претходно необјављени резултати сопствених истраживања научним методом према шеми IMRAD (Introduction, Methods, Results and Discussion));
2. прегледни научни чланак (рад који садржи оригиналан, детаљан и критички приказ истраживачког проблема у коме је аутор остварио одређен допринос, видљив на основу аутоцитата);
3. кратки научни чланак (изворни научни чланак који сажима резултате изворног истраживачког дела или дела које је још у току);
4. стручни чланак (у коме се саопштавају позната сазнања и резултати изворних истраживања, са намером ширења информација и сазнања, као и њихове примене у пракси).

Осим научних и стручних радова, у часопису *Иновације у настави* објављујемо преведене радове, информативне прилоге и приказе (књига, рачунарских програма, образовних софтвера, научних догађаја и др.), као и стручне информације.

Рукописи се шаљу електронском поштом и не враћају се. Електронска адреса редакције је: inovacije@uf.bg.ac.rs. Аутори могу послати радове на српском, енглеском, руском или француском језику. Сви радови који добију позитивне рецензије биће објављени у часопису на језику на ком су написани. Уколико аутори желе да рад буде објављен у часопису на страном језику (енглеском, руском или француском), неопходно је да га преведу на језик који су одабрали.

Сви радови се анонимно рецензирају од стране два компетентна рецензента. **Аутор је дужан да у писменој форми редакцију упозна са свим изменама које је начинио у тексту (број странице на којој се налази измена и означавање места на коме је промена извршена), у складу са примедбама и пре-**

порукама рецензената. Након тога, уређивачки одбор доноси одлуку о објављивању. О томе обавештава аутора у року од три месеца.

Рад приложен за објављивање треба да буде припремљен према стандардима часописа *Иновације у науци* како би био укључен у процедуру рецензирања. **Неодговарајуће припремљени рукописи биће враћени аутору (одн. ауторима) на дораду.**

СТАНДАРДИ ЗА ПРИПРЕМУ РАДА

Фонт. Рад треба да буде написан у текст процесору Microsoft Word, фонтом Times New Roman, величине 12 тачака. Параграфи: фонт – Normal, проред – 1.5, први ред – увучен аутоматски (Col 1).

Обим. Прегледни и истраживачки радови могу бити дужине до једног ауторског табака (16 страна, око 36.000 знакова), кратки научни чланци, критике, полемике и осврти, као и стручни и преведени радови до 8 страна (око 15.000 знакова); извештаји и прикази до 2–3 стране (приближно 3800–5600 знакова). Уредник задржава право да објави обимније радове када изражавање научног садржаја захтева већи простор.

Општи подаци о ауторима. Име, средње слово и презиме аутора наводи се у првом реду, а у следећем се даје институција у којој ради. Испод тога треба навести адресу становања или институције у којој је аутор запослен и годину рођења (година рођења се не објављује, али се користи приликом класификације радова у Народној библиотеци Србије). Позиција: left. Поред свог имена аутор додаје фусноту, у чијем садржају на дну странице наводи своју електронску адресу. Ако је аутора више, треба дати само адресу једног, обично првог. Уколико рад потиче из докторске дисертације, у фусноти уз наслов треба да стоји и назив тезе, место и факултет на којем је одбрањена. За радове који потичу из истраживачких пројеката треба навести назив и број пројекта, финансијера и институцију у којој се реализује.

Наслов рада. Три реда испод имена. Фонт: Times New Roman, 12, bold; позиција: center.

Резиме. Може бити дужине 150–300 речи, налази се на почетку рада, један ред испод наслова. Садржи циљ рада, примењене методе истраживања, најзначајније резултате и закључке. **Редакција обезбеђује превод тезе на енглески језик или превод тезе на друге језике.** Редакција не обезбеђује превод радова у целини на стране језике.

Кључне речи. Наводе се иза резимеа. Треба да их буде до пет, пишу се италиком стандардним словима и одвојене су зарезом (иза последње стоји тачка).

Основни текст. Радове треба писати језгровито, разумљивим стилем и логичким редом. Он, по правилу, укључује уводни део, који се завршава одређењем циља или проблема рада, опис методологије, приказ добијених резултата, дискусију резултата и закључак са препорукама за даља истраживања или за праксу.

Референце у тексту. Све референце на српском језику у списку литературе и у заградама у тексту наводе се латиницом, без обзира на врсту коришћеног писма у тексту и писма на коме су штампани коришћени извори – књиге и часописи. На литературу се упућује у загради у самом тексту, а не у фусноти. Имена страних аутора у тексту се наводе у српској транскрипцији (према одредбама у важећем Правопису), а затим се у загради наводе изворно, уз годину публикавања рада. Пример: Мејер (Meуer, 1987). Када постоје два аутора рада, наводе се презимена оба, док се у случају већег броја аутора наводи презиме првог и скраћеница „i sar.“ уколико је реч о раду на српском, или „et al.“ уколико је реч о раду на страном језику.

Цитати. Сваки цитат, без обзира на дужину, треба да прати референца са бројем стране. Пример: (Meуer, 1987: 38).

Табеле, графикони, схеме, слике. Треба да буду сачињени у Word-у или неком њему компатибилном програму. Табеле из статистичких пакета треба „пребацити“ у Word. Свака табела, схема, слика и сваки графикон морају бити разумљиви и без читања текста, односно, морају имати редни број, наслов (прецизан, не дужи од једног реда) и легенду (објашњења ознака, шифара и скраћеница). Слике треба припремити у електронској форми са резолуцијом од 300dpi и у формату jpg. Табеле, схеме, слике и графикони треба да буду распоређени на одговарајућа места у тексту. Приказивање истих података табеларно и графички није прихватљиво. За илустрације преузете из других извора (књига, часописа) аутор је дужан да упути на извор. Осим тога, потребно је да прибави и достави редакцији писмено одобрење власника ауторских права.

Резултати статистичке обраде. Треба да буду дати на следећи начин: $F=25.35$, $df=1,9$, $p<.001$ или $F(1,9)=25,35$, $p<.001$ (како је уобичајено у статистици педагошких и психолошких истраживања).

Фусноте и скраћенице. Нису дозвољене, осим у изузетним случајевима.

Списак литературе. На крају текста у складу са АПА (Америчка психолошка асоцијација) треба приложити списак литературе на коју се аутор позивао у раду. Референце се наводе абecedним редом по презименима аутора на следећи начин:

КЊИГА

Sahlberg, P. (2011). *Finnish Lessons. What can the world learn from educational change in Finland?* New York: Teacher College Press, Teachers College, Columbia University.

Radovanović, I., Radović, V. Ž. i Tadić, A. (2009). *Inovacije u nastavi – bibliografija radova (1983–2008)*. Beograd: Učiteljski fakultet.

ПОГЛАВЉЕ У КЊИЗИ

Havelka, N. (2001). Udžbenik i različite koncepcije obrazovanja i nastave. U: Trebješanin, B. i Lazarević, D. (ur.). *Savremeni osnovnoškolski udžbenik (31–58)*. Beograd: Zavod za udžbenike i nastavna sredstva.

ЧЛАНАК У ЧАСОПИСУ

Gašić Pavišić, S. (2009). Znanja i uverenja budućih učitelja o vršnjačkom nasilju među učenicima. *Inovacije u nastavi*, 22 (4), 71–84.

ПРИЛОГ У ЗБОРНИКУ

Ristić, M. (2009). Vrednovanje znanja učenika u sistemu e-učenja. *Inovacije u osnovnoškolskom obrazovanju – vrednovanje (522–530)*. Beograd: Učiteljski fakultet.

ВЕБ-ДОКУМЕНТИ

Kallestad, J. and Olweus, D. (2003). Predicting Teachers and Schools Implementation of the Olweus Bullying Prevention Program: A Multilevel Study. *Prevention and Treatment*, Vol. 6, No. 2. Retrieved May 18, 2000. from www: <http://www.vanguard.edu/psychology/apa.pdf>.

У списку литературе наводе се само референце на које се аутор позива или које је анализирао у прегледном чланку.

Када се исти аутор наводи више пута, поштује се редослед година у којима су радови публиковани. Уколико се наводи већи број радова истог аутора публикованих у истој години, радови треба да буду означени словима уз годину издања нпр. 1999а, 1999б... Навођење необјављених радова није пожељно.