ASYMMETRICAL PEER INTERACTION
AND FORMAL OPERATIONAL DEVELOPMENT:
DIALOGUE DIMENSIONS ANALYSIS[*]

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Abstract. The main goal of the study is to define dialogue dimensions in order to describe the interaction within peer dyads and potentially connect them with formal operations development in the less competent participants. Its significance is related to rare investigations of this subject in the context of formal operations development and to practical implications regarding peer involvement in education process. The sample included 316 students aged 12 and 14. The research had an experimental design: pre-test, intervention and post-test. In the pre-test and the post-test phases students solved the formal operations test BLOT. According to the pre-test results, 47 dyads were formed where less and more competent students jointly solved tasks from BLOT. Their dialogues were coded by 14 dimensions operationalized for this purpose. Correlations between the dialogue dimensions indicate clearly distinguished positive and negative interaction patterns. There are no connections between dialogue dimensions and progress of less competent adolescents on BLOT in the entire

sample, but several are found in the subsamples. Arguments exchange seems to be the most encouraging dialogue feature regarding formal operations development, particularly in older students. This confirms relevant research data and the expectations about peers' constructive role in fostering cognitive development.

Key words: asymmetrical peer interaction, dimensions of dialogue, formal operations.

Introduction

One of the main critics of formal operations in Piaget's theory refers to its low incidence in adolescence, even in adulthood (Cole & Cole, 1993; Normandeay, Larivee, Roulin & Langeot, 1992; Peel, 1971; Shayer, Küchemann & Wylam, 1992). Many authors (Bond 1978–1979, 1995; Lourenco & Machado, 1996; Montangero, 1991) impugn this critique, but Kuhn (1979) argues that education nevertheless should support formal operations development. Webb (2001) emphasizes peers should have the central place in promoting formal operations at school because they are excellent models for new skills development. They provide more understandable explanations than adults hence less competent students could gain from the interaction with more competent peers, who can also advance by developing better ideas conceptualization. However, there are not many studies of peer interaction in the context of formal operations development. According to Piaget (1941/1999, 1950/1999, 1960/1999) peers are crucial for logic development. *Cooperation* characterizes their relations because, unlike child-adult relationship, their affairs presuppose social symmetry. Cooperation supports logical thinking because it is based *on a common scale of reference* where partners share similar notion meanings, feel obligation to *conserve their positions* in a discussion and establish *reciprocity* through coordination of their points of view (Piaget, 1941/1999).

Piaget never tested peer interaction effects, but his followers created a rich corpus of empirical data building a new perspective on this phenomenon. Their studies are divided into three periods (De Abreu, 2000; Perret-Clermont, 1993; Psaltis, 2005a, 2005b). The first generation examined socio-cognitive conflict, a joint engagement of subjects with different perspectives on the same task. Although numerous studies revealed its productive influence, it is concluded that certain preconditions were necessary for such effect (Perret-Clermont, 1980; Psaltis, 2005a). Peers' awareness of different positions and attempt to coordinate them are crucial (Perret-Clermont, 1980). The second generation was more oriented towards the interaction process than its effects. No symmetry in peer relation was found, as Piaget assumed. On the contrary, representations and expectations of different asymmetries between peers (related to gender, academic reputation, social class) exceeded their cognitive asymmetry and influenced interaction outcomes (De Abreu, 2000; Perret-Clermont, 1980; Psaltis, 2005a; Schubauer-Leoni & Grossen, 1993). The third generation integrates findings of previous studies thoroughly examining peer dialogue.

Vygotsky's followers were focused on cognitive asymmetry of adult-child interaction. They further developed the zone of proximal development concept (ZPD) specifying adult mediation tools. Wertsch defined notions such as *negotiation of meaning*, *joint construction of meaning* and *division of responsibilities.* More precisely, within a joint activity adult takes upon themselves functions not fully developed in a child and lets it embrace the functions it is capable of, while supervising and guiding the child (Wertsch, McNamee, McLane & Budwig, 1980; Wertsch, 1991). Wood (Wood & Wood, 1996) introduced *scaffolding metaphor* where adult assists by setting goals and providing activity goals reminders. Researches of peer interaction appeared later within this approach. The discoveries regarding ZPD influenced those studies supplying them with relevant concepts network. Since language is treated as the powerful mediating tool many investigations were focused on detailed analysis of peer communication. Considering school as a learning context Mercer and associates examined the role of different types of peer conversation in the classroom in knowledge construction (Rojas-Drummond & Mercer, 2003; Mercer & Littleton, 2007).

The problem

This work deals with the role of asymmetrical peer interaction in formal operations development. Dyads formed of students with different competences regarding formal operational thinking have been investigated. The main goal is to operationalize relevant dialogue dimensions to describe peer interactions and relate them to interaction effects on the formal operations development in the less competent students. Interaction qualities originated from theoretical assumptions and research results within two discussed approaches were classified into two main categories regarding the expected outcomes: positive supporting cognitive development and *negative* disabling such effect.

When it comes to *positive peer interaction qualities* Piaget (1941/199) emphasized *cooperation* as a form of peer arguments interchange which provokes cognitive conflict leading to formal operations development. The first generation studies defined and empirically examined the socio-cognitive conflict. Psaltis (2005a) brought up the distinction between a shared and non-shared cognitive conflict. *A shared conflict* implies a situation where partners register a disagreement while openly supporting their views, which results in a conflict. *A non-shared conflict* exists when one participant does not externalize his resistance or doubt and publicly agrees with the partner thus creating a wrong impression that all participants share the same representation of reality, which Psaltis calls a fake intersubjectivity. Hence the findings show the importance of *partners' active role* and *arguments exchange* for a fruitful interaction (Perret-Clermont, 2004; Psaltis, 2005a). Predominantly interested in the dialogue, the authors of the third generation (Dimant & Bearison, 1991; Leman, 2002; Psaltis & Duveen, 2006, 2007) discovered its productive char-

acteristics: *a shared socio-cognitive conflict*, a change of perspective as a result of the interaction with a more competent partner (*a-ha moment*), partner's *explanation of an offered judgment, asking each other questions*.

Although Vygotsky (1977) does not specify adults' behaviour resulting in cognitive change within ZPD, he mentions participants' active involvement in the interaction, asking questions and adjustment of adult's assistance at the child's cognitive level. His followers made significant progress in adults' mediation operalization. Forman (Forman & Larreamendy-Jones, 1995) uses Wertsch's notion of *the division of responsibilities* in the context of peer interaction and emphasizes its productive role. Many authors (Forman & Larreamendy-Jones, 1995; Kumpulainen & Kartinen, 2003; Tudge, Winterhoff & Hogan, 1996; Tudge & Rogoff, 1999; Shamir & Tzuriel, 2004) found that *negotiation of meaning* and *joint construction of meaning*, also introduced by Wertsch, make peer interaction constructive. Similar to Piagetian authors, Tudge (Tudge *et al*., 1996) states that the competence difference between peers is not sufficient for effective interaction. The crucial factor is *shared understanding* which can be reached if *more competent partner justifies* his claims, if his *behaviour is consistent* (continuity of correct reasoning) and if *partner understands his explanations*. Finnish authors (Kumpulainen & Kartinen, 2003) point out interaction dimensions on communication level (*providing relevant information, asking and answering questions, answer justification, thinking aloud*) and social level (*cooperation* between peers, *making effort towards joint construction of meaning*) related to productive interaction. Similarly, Mercer found that exploratory talk (*active listening, asking questions, arguments exchange*) between peers in the classroom has a positive influence on the knowledge construction (Mercer & Littleton, 2007; Rojas-Drummond & Mercer, 2003).

Negative interaction qualities were not considered by Piaget and Vygotsky. Questioning Piaget's view of peer interaction as an ideal form of reciprocity, his followers found that its effects depend on peer roles and status influencing the nature of their relation, but also on representations related to broader context (De Abreu, 2000; Psaltis, 2005a; Psaltis & Duveen, 2006, 2007; Schubauer-Leoni & Grossen, 1993). It is discovered that social marking may have a negative impact on the interaction producing *domination*, *submissiveness*, *withdrawal*, *disputation*, *imposition of the opinion* and other behaviour forms which jeopardize collaboration. Vygothskian authors do not explicitly discuss the factors that change interaction in the way that Piagetians suggested. However, interpreting findings related to absence of the interaction impact they specify related features: *giving opinion without explanation, unresolved difference of opinion, domination, aim to quickly reach a joint solution without exchanging arguments*.

Presented theoretical foundations and empirical data are deemed a solid ground for conceptualization of relevant interaction dimensions to be discussed in the next section.

The Method

The sample was convenient and consisted of 316 students from 3 primary schools in Belgrade. It included 2 subsamples: younger primary school students, 6 classes from grade 6 (152 students, aged 12) and older primary school students, 6 classes from grade 8 (164 students, aged 14).

The research had an experimental design: pre-test, intervention and post-test. In the pre-test and the post-test phase students solved the test of formal operations BLOT. According to the pre-test results, 47 dyads were formed (21 in the younger and 26 in the older subsample), including less competent and more competent students of the same sex. Competence difference across dyads was approximately the same (around 1.5 logits), which is accomplished by Rasch analysis. During the intervention phase dyads solved 5 tasks from the parallel version of BLOT. They received instructions from an experimenter to solve tasks together and agree on the correct solution. All dyads were videotaped. The tasks were chosen according to the principle that all tasks in the pre-test were correctly solved by a more competent student and incorrectly by a less competent one. The first control group consisted of students matching the less competent dyad members according to pre-test results who did nothing during the intervention. The second control group is not particularly relevant for this study. It consisted of students also matching less competent dyad members regarding pre-test score, who individually solved 5 tasks from the parallel version corresponding to 5 tasks incorrectly solved in pre-test (more details regarding research design see Stepanović, 2012). A month after the intervention, the post-test took place. It is important to mention that less competent members of dyads and the second control group progressed significantly (around 0.8 logits) unlike the first control group and their more competent partners (see Stepanović, 2012).

Two instruments were used: BLOT and the interaction dimensions list created to code peer dialogues. Bond's Logical Operations Test (BLOT) is a multiple choice test covering all formal operations described by Inhelder and Piaget (1958), with good metric characteristics (Bond, 1978-1979, 1989, 1995). It was translated into Serbian and showed good measurement features (Stepanović, 2004). Tasks which students solved in the intervention phase were taken from the parallel version of BLOT constructed in a separate research (Stepanović Ilić, Baucal & Bond, 2012).

The list of dialogue dimensions includes 14 dimensions:

(1) *Answer explanation* (*E*) – provided by the more competent dyad member. This dimension shows decentration ability and cooperation considered by Piaget (Piaget, 1941/1999). Research within socio-cultural approach also suggest significance of argumentation (Mercer & Littleton, 2007; Tudge *et al.*, 1996).

(2) *Shared socio-cognitive conflict* (*SSC*) – dyad members give different solutions (the more competent one provides correct solution).

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(3) *Guidance* (*G*) – by the more competent peer who focuses partner's attention on the relevant task aspects, asks questions, provides explanations, checks partner's task comprehension, monitors his reasoning. This dimension clearly originates from Vygotskyan paradigm and presupposes mediation of less competent adolescent's activity by his more competent peer.

(4) *Arguments exchange* (*AE*) – through joint problem solution. This dimension implies active and productive involvement of both participants. This is one of the crucial aspects of ZPD notion (Baucal, 2003; Tudge *et al.*, 1996). Opinions exchange is essential for building intersubjectivity which is an important characteristic of fruitful interaction recognized by both approaches.

(5) *Aha moment* (*Aha*) – the less competent peer understands partner's argumentation, accepts it and verbalizes his new perspective of the task as a monologue or as a feedback for the partner. Psaltis (Psaltis, 2005a, 2005b; Psaltis & Duveen, 2006, 2007) refers to this dimension as an *explicit recognition* when the less competent participant comprehends the problem from a new perspective and explicates that.

(6) *Inconsistent behavior* (*IB*) – of the more competent participant not manifesting higher abilities consistently: gives incorrect solution, has doubts or agrees with a wrong solution suggested by his peer. This dimension is emphasized by Vygotskian authors, particularly Tudge (Tudge *et al.*, 1996), but it is also recognized by Piagetians (Pere-Klermon, 2004).

(7) *Domination* (*D*) – one student imposes the solution or obstructs partner to voice his opinion. Domination implies cooperation absence caused by intrusive behaviour of one participant. This dimension was mentioned as obstructive by authors of the second and third generation within Piaget's approach.

(8) *Leaving the initiative to the partner* (*L*) – solving the task and suggesting the solution is left to the partner. This dimension indicates passivity of one participant who leaves all decisions to the partner.

(9) *Submissiveness* (*S*) – acceptance of peer's answer without provided justification. Submissiveness differs from the previous dimension because one participant is not passive during task solving, but at the end he accepts partner's solution despite the absence of his explanation. Authors of the second and third generation state that this dimension often goes with the domination of the other peer.

(10) *Contradicting* (*C*) – one student contradicts the proposals and explanations of his peer without making suggestions. Similarly to the *Domination,* this dimension implies unwillingness of one participant for dialogue. This characteristic of peer conversations is mentioned by Piaget (1923/2002).

(11) *Lack of interest* (*LI*) – for task solving in one or both partners. Partners talk about something irrelevant. If one partner is not interested he looks aside and does not respond to partner's attempts to involve him in conversation. This dimension shows unwillingness of one or both participants for task solving and consequently lack of cooperation.

(12) *Individual problem solving* (*I*) – participants think of the task individually and ascertain at the end that they chose the same solution. According to Jovanović and Baucal (2007) this dimension shows a lack of cooperation because peers solve the problem individually.

(13) *The less competent participant solves task by himself* (*LBH*). During the intervention it was observed that some less competent students manage to solve task quickly and independently. It is important to register those cases because they do not represent the interaction effect.

(14) *Reverse socio-cognitive conflict* (*RSC*) – the less competent peer proposes the correct solution while his partner chooses a wrong one. This situation, like previous dimension, was also noticed during the intervention.

The first 5 dimensions are considered positive regarding the potential interaction influence on the less competent students. Accordingly, dimensions 6–12 are negative and the remaining two dimensions (13, 14) actually are not a product of the interaction.

The coding was performed by two observers independently (one author of the study and trained PhD student) who watched dialogues and read dialogue transcripts. The raters registered dialogue dimensions appearing in all five dialogues in each dyad. Although we had 47 dyads, dialogue coding was realized for 45 because 2 dyads were so silent that transcription was impossible. Since dyads solved 5 BLOT tasks each of 5 dialogues per dyad was coded by 14 dialogue dimensions. Therefore, if we take into account one dyad, each of 14 dimensions might be registered by the raters from 0 (did not show in dialogues) to 5 times (showed in all 5 dialogues). Inter-rater agreement was satisfied (Cohen's kappa 0.78).

Results

Table 1 shows the dialogue dimensions frequency from the perspective of one dyad.

Table 1: Frequencies of dialogue dimensions

Dimensions of peer dialogues	Average frequency per dyad	Standard deviation	Minimal frequency per dyad	Maximal frequency per dyad
Answer explanation (E)	1.56	1.35	0	5
Inconsistent behaviour (IB)	1.43	1.11	0	4
Submissiveness (S)	1.11	1.31	0	5
Shared socio-cognitive conflict (SCC)	1.05	1.35	0	5
Domination (D)	0.83	1.27	0	1
Less competent participant solves problem by himself (LBH)	0.79	0.81	0	3
Arguments exchange (AE)	0.52	0.92	0	4
Guidance (G)	050	0.83	0	4
Individualism (I)	0.45	0.80	0	3
Leaving initiative to the partner (L)	0.40	0.86	0	3
A-ha moment (Aha)	0.26	0.44	0	1
Reverse socio-cognitive conflict (RSC)	0.19	0.40	0	1
Lack of interest (LI)	0.07	0.46	0	3
Contradicting (C)	0	0	0	0

The most frequent dimensions of peer dialogues are: *Answer explanation*, *Inconsistent behaviour*, *Submissiveness* of the less competent participant mostly and *Shared socio-cognitive conflict*. They are present in every dialogue within some dyads and absent from the conversation in other dyads which suggests huge difference among dyads. It is also indicated by large standard deviations. *Domination*, mostly of the more competent participants, is relatively frequent as well as the situation where less competent participants manage to solve tasks by themselves (*LBH*) which is not surprising since tasks were selected so that one in 5 was in their zone of actual development and other 4 were in ZPD. *Guidance* and *Arguments exchange* are relatively rare. *Contradicting* did not occur, and *Lack of interest* is almost absent.

Table 2: Correlations between dialogue dimensions

	E	SSC	G	AE	Aha	IB	D	L	S	C	LI	I	LBH	RSC
E	1													
SSC	**.50***	1												
G	**.47**	**.39****	1											
AE				1										
Aha	.34			.31	1									
IB	-.31	-.43				1								
D							1							
L								1						
S	-.42		-.35	-.34			.39		1					
C										1				
LI							.39				1			
I	-.32											1		
LBH	-.38											.55	1	
RSC	-.33					.36								1

Legend. * Correlation significant on the level .01 are presented in bold. ** Correlation significant on the level .05 are presented in regular font, insignificant correlations are not presented in the table.

Correlations between dialogue dimensions (Table 2) are quite logical and provide insight into specific interaction patterns. *Answer Explanation* is positively related to other positive dialogue features *Shared socio-cognitive conflict*, *Guidance* and *Aha moment* experienced by the less competent student. Negative correlations of this dimension with *Submissiveness* and *LBH* are expected since one presupposes acceptance of an unexplained solution by the less competent student and the other his capability to solve the task individually. A negative relationship with *RSC* is also understandable because in this situation partners' roles are inverted and the answer explanation by the more competent peer is unlikely. A positive connection between *Shared socio-cognitive conflict* and *Guidance* implies that the more competent students were sensitive towards their peer and mediated his reasoning when he proposed a wrong answer. Besides, *SSC* negatively correlate with *Inconsistent behaviour* which is normal since it presupposes correct reasoning of the more competent student. Negative relationship between *Guidance* and *Submissiveness* implies that good collaboration assumes engagement of both partners. Thus, the mediation effort by the more competent student should not be accomplished with a passive reaction of his peer. *Arguments exchange* positively correlates with *Aha* and negatively with *Submissiveness*. These relationships also indicate that productive interaction has to be based on cooperation. There are some expected relations among negative dimensions: *IB* positively correlates with *RSC* as well as *Domination* with *Submissiveness* and *Lack of interest*. The first correlation describes an interaction pattern where the more competent student does not manifest his capacities, and the other two represent unproductive interaction patterns caused by dominant behaviour of one participant, mostly the more competent one.

Frequency of dialogue dimensions are correlated with the score difference between post-test and pre-test of the less competent peers. The aim is to discover if these dimensions can be potentially related to progress in formal operations development. Dialogue dimensions are correlated with the progress of the less competent students in ZPD as well as with the number of correctly solved tasks during the intervention.

There is no dialogue dimension related to the progress of the less competent peers on the post-test or with the progress in ZPD. However, some dialogue dimensions correlate with the number of successfully solved tasks in collaboration. Dyads where the more competent peer explained his answers solved more tasks than dyads where such behaviour was absent (r=0.37, p<0.05). Dyads where a socio-cognitive conflict was obvious were more successful than those where it was not (r=0.32, p<0.05). A strong negative correlation appeared between *IB* and the number of solved tasks during the intervention (r =-0.74, p<0.01).

In the younger subsample *AE* is positively related to the progress on BLOT (r=0.461, p<0.05). Correlations with other dialogue dimensions are not found. As in the entire sample, a strong negative correlation (r=-0.83, p<0.01)

exists between the number of solved tasks and *IB*. In the older subsample *Submissiveness* is negatively related to the progress on BLOT (r=-0.44, p<0.05), while *AE* positively correlates with the progress of the less competent peer in ZPD (r=0.55, p<0.01). The number of correctly solved tasks in collaboration positively correlates with *AE* (r=0.44, p<0.05) and negatively with *IB* (r=-0.650, p<0.01). These relationships are also found in the entire sample.

Discussion

The aim of the research was to define dialogue dimensions in order to describe asymmetrical peer interaction and potentially relate them with cognitive change regarding formal operations development in the less competent students. Among 14 operationalized dimensions the most salient are answer argumentation by the more competent peer and shared socio-cognitive conflict, which are usually connected with a productive interaction. The most noticeable negative dimensions are inconsistent behaviour of the more competent students and submissiveness, mostly of the less competent peers. The first one implies an unstable formal operations structure in the more competent students which make them unconstructive partners unlikely to support the cognitive change in the peer. Submissiveness means that interaction is jeopardized on the social level of communication since one participant is not ready to make an effort towards joint construction of meaning (Kumpulainen & Kartinen, 2003). The frequencies of dialogue dimensions are relatively low, but very high standard deviations indicate huge differences between dyads. Comparison with data of Jovanović and Baucal (2007), who used analogous dimensions, shows that argumentation, guidance and submissiveness are less frequent than in their study, while domination and leaving initiative to the partner have similar frequency.

Correlation analysis among dialogue dimensions outlines several interaction patterns. A shared socio-cognitive conflict seems to encourage the more competent adolescents to provide explanations and guide their peers. This is in accordance with findings that an obvious conflict inspires the more competent peer to motivate the partner for joint work (Pere-Klermon, 2004; Psaltis, 2005a). This also shows that the more competent student is sensitive to his peer's needs and ready to give assistance (Garton & Prat, 2001; Kovač-Cerović, 1998; Tudge, 1992; Tudge & Rogoff, 1999). Providing explanation by the more competent peers and arguments exchange is accompanied with new insights into their partners which can be related to the significance of the argumentative discourse for Vygotskyans (Mercer & Littleton, 2007; Rojas-Drummond *et al.*, 2003; Rojas-Drummond & Mercer, 2003; Tudge *et al.*, 1996) and to Piaget's considerations of cooperation (1941/1999, 1950/1999). Psaltis (Psaltis, 2005a, 2005b; Psaltis & Duveen, 2006) argues that explicit recognition in less competent students is one of the most important characteristics of productive dialogues. Domination is paired with submissiveness as

registered by Piagetians, but also with the other peer's lack of interest. These patterns imply the absence of reciprocity and joint activity. The values of obtained correlations between dialogue dimensions suggest no overlapping between them which indicates that they describe different dialogue qualities.

There are no connections between dialogue dimensions and progress of the less competent adolescents on BLOT test in the entire sample. The relation is not found either with progress on the tasks within their ZPD. This is surprising since dialogue dimensions are operationalized in accordance with theoretical assumptions and empirical data of the relevant research. Still, some dialogue dimensions are related to the success in joint tasks solving. When the more competent peer explained the answers more tasks were solved. Dyads with inconsistent behaviour of the more competent partner solved fewer tasks than those where he acted in accordance with his abilities. Within subsamples several dialogue dimensions are related to the progress of the less competent adolescents on the BLOT. Younger less competent peers progressed more if they exchanged arguments with their partners. This is in accordance with the significance of Piaget's cooperation concept for logic development and with findings of Vygotskyan authors regarding the productive role of argumentation. In the older subsample, submissive students accepting unexplained answers of the more competent peer progressed less than those who did not manifest such behaviour. This interaction pattern actually includes two features of unsuccessful dialogue: absence of ability for decentration in more competent student and insufficient engagement of his peer. Submissiveness can be treated as a personality trait but Piagetian researches show that it could be a reflection of the way participants define the situation of joint problem solving. Status, roles and the social relationship between peers as well as their representations of the broader context in which the interaction occurs, influence the course and outcomes of collaboration (De Abreu, 2000; Pere-Klermon, 2004; Schubauer-Leoni & Grossen, 1993). Older less competent peers progress more on the formal operations test, even in ZPD, when argument exchange was present in dialogues. This finding is very important since it suggests construction of new abilities. It confirms again the significance of active involvement of both participants and joint construction of meaning.

Conclusion

Operationalization of dialogue dimensions was successful regarding their usage in the description of different interaction patterns. The positive and negative patterns are obviously distinguished and in accordance with relevant studies. The relations between several dialogue dimensions and the progress of the less competent dyad members are found on the level of subsamples. They confirmed the data from both leading approaches about the crucial role of constructive engagement of both peers and the position coordination in the dialogue for a productive interaction. Moreover, the relevance of argument

exchange for the progress on formal operations test in younger and especially in older students, where it is related to progress in ZPD, validate Piaget's assumptions about the importance of peers' cooperation for the development of formal operations. The construction of new abilities in older adolescents as a result of peer interaction may be related to researches regarding formal operations (Danner & Day, 1977; Kuhn, 1979; Stone & Day, 1978) which indicate that this form of thinking has to be developed to a certain extent in order for particular factors to be effective in its encouragement. The finding regarding the significance of argumentation in peer dialogue supports Kuhn's and Webb's thesis about the necessity of peer engagement in education process for the formal operations development. Besides, Mercer's researches show that exploratory talk in the classroom, based on argument exchange, unequivocally leads to knowledge construction. In that context, a negative impact of submissiveness should also be considered, since our results in the older sample demonstrate that social asymmetry between peers can be a disturbing factor for cognitive development stimulation. For that reason teachers have to be sensitive and reflect on it thoughtfully in everyday practice, as Piaget's followers pointed out.

The absence of the relation between dialogue dimensions and the progress of the less competent students on the formal operations test in the entire sample suggests that the sample should be enlarged and the list of dimensions considered again and consequently revised. When observed together with the data regarding large differences in the presence of dimensions in dialogues among dyads, this finding in our opinion primarily indicates that a macro analysis of peer interaction should be combined with a micro analysis as suggested by some authors (Kumpulainen & Kartinen, 2003; Psaltis & Duveen, 2006; Wegerif & Mercer, 1997). Although macro analysis enables quantification and generalization of results, it reduces the dialogue to the presence of dimensions and blurs its complexity. Micro analysis has its own disadvantages but it enables one to fully understand peer dialogue which is very important for teachers and their educational goals.

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Ивана Степановић Илић, Александар Бауцал и Јелена Пешић
АСИМЕТРИЧНА ИНТЕРАКЦИЈА И РАЗВОЈ ФОРМАЛНИХ ОПЕРАЦИЈА:
АНАЛИЗА ДИМЕНЗИЈА ДИЈАЛОГА
Апстракт

Циљ истраживања представља дефинисање димензија дијалога којима би се описала вршњачка интеракција и њихово евентуално повезивање са равојем формалних операција код чланова дијада нижих компетенција. Ова тема је ретко истраживана у контексту развоја формалних операција. Практичне импликације везане су за улогу вршњака из одељења у подстицању когнитивног развоја. Узорак чини 316 ученика, узраста 12 и 14 година. Дизајн студије био је експериментални и састојао се од 3 фазе: пре-тест, интервенција и пост-тест. У пре-тест и пост-тест фази ученици су решавали тест формалних операција BLOT. На основу резултата пре-теста формирано је 47 дијада, у оквиру којих су ученик који има више и ученик који има ниже компетенције током фазе интервенције заједно решавали задатке BLOT теста. Њихови дијалози су кодирани помоћу 14 димензија, операционализованих за потребе ове студије. Корелације између димензија дијалога указују на постојање позитивних и негативних обарзаца интеракције. На нивоу целог узорка нису утврђене везе димензија дијалога са напредовањем ученика нижих компетенција на пост-тесту, али су установљене неке везе нађене на подузорцима. За развој формалних операција најподстицајнију димензију дијалога представља размена аргумената, посебно када су у питању старији ученици. Резултати су у складу са релевантним истраживањима, као и са очекивањима у погледу конструктивне улоге вршњака у подстицању когнитивног развоја током образовног процеса.

Кључне речи: асиметрична вршњачка интеракција, димензије дијалога, формалне операције.

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АССИМЕТРИЧНОЕ ВЗАИМОДЕЙСТВИЕ
И РАЗВИТИЕ ФОРМАЛЬНЫХ ДЕЙСТВИЙ:
АНАЛИЗ СОСТАВЛЯЮЩИХ ДИАЛОГА
Резюме

Цель настоящего исследования – определить составляющие диалога, которыми можно описать взаимодействие сверстников и выявление их возможной связи с равитием формальных действий у членов диад компетенций более низкого уровня. Данная тема редко исследовалась в контексте развития формальных действий. Практические импликации связаны с ролью одноклассников в поощрении когнитивного развития. Число испытуемых составило 316 учащихся в возрасте 12 и 14 лет. Исследование имело экспериментальный характер. Оно состояло из трех этапов: предварительного теста, интервенциии и последующего теста. На этапах предварительного и последующего тестирования учащиеся решали тест формальных действий BLOT. На основании результатов предварительного теста было установлено 47 диад, в рамках которых учащиеся с более высокими и учащиеся с более низкими компетенциями на этапе интервенции совместно решали задачи теста BLOT. Их диалоги были кодированы при помощи 14 составляющих, опперационализованых для нужд данного исследования. Корреляции между составляющими диалога указывают на существование положительных и отрицательных образцов взаимодействия. На уровне всего корпуса не были выявлены связи измерений диалога с продвижением учащихся с более низкими компетенциями на последующем тесте, однако, выявлены некоторые связи, присущие определенным частям корпуса. Для развития формальных действий наиболее поощряющей составляющей диалога является обмен аргументами, в частности у учащихся старшего возраста. Результаты соответствуют релевантным исследованиям, а также ожиданиям в связи с конструктивной ролью однолассников в поощрении когнитивного развития в ходе образовательного процесса.

Ключевые слова: ассиметричное взаимодействие сверстников, составляющие диалога, формальные действия.