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How does dialogical talk promote student learning during small group work? An exploratory study

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ABSTRACT

This article reports on a study which analysed the dialogue among students working in small groups. The main aim of the analysis was to identify types of interaction through the analysis of student-student talk. The study also examined the association between types of interaction and correctness of the answers provided by the students to the task. Results suggest that "dialogic interaction", as a type of action based on the use of validity claims (including conjectures, reasoning and proof) within the dialogue, is associated with correctness, since participants must justify their answers drawing on validity claims that are susceptible of being verifiable by all participants in the group. The findings provide evidence to advance our knowledge about what is it about dialogic interaction that promotes learning, opening up new avenues for teachers to improve their practice within the classroom.

1. Introduction

This article intends to understand further dialogue and social interaction among students to negotiate responses to an open-ended task of mathematics. We analyse the dialogue among students working in small groups (four to six students) in an assigned collaborative task within the *Social Unit of Learning* research project (Chan, Clarke, & Cao, 2018), seeking to identify signs or indicators that may characterise student-student talk to identify different types of interaction among them when they solve open-ended mathematical tasks.

There is little doubt about the role that language plays in mediating learning in social settings, and that social interaction is a crucial aspect of learning (Aguilera-Jiménez and Prados, 2020; Álvarez-Guerrero et al., 2021; Racionero & Padrós, 2010; Zubiri-Esnaola et al., 2020). Resnick et al. (1993) found evidence that learning emerged through participation in dialogue during small group peer work involving collaborative argumentation. They adopted the concept of *accountable talk* (Resnick et al., 2018), claiming that it includes reasoning, knowledge and learning community. According to them, learning is a social process in which participants engage in a dialogue respecting each other's ideas (learning community) about facts, claims, and rational justification. By sharing their points of view (assumptions, opinions, claims, etc.), learners attempt to shape their understanding (Barnes & Todd, 1977), elaborating on others' arguments to reach a further (and even richer) understanding of the topics discussed. Snell and Lefstein (2018) found similar evidence

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claiming that students develop their identities as productive learners participating in *productive* interactions (versus *unproductive* ones). They also use the concept of *academically productive talk* (as used by Resnick et al., 2015) to argue that dialogic teaching opens the possibility for learners participating in the dialogue to share knowledge through the argumentative process. Similar results have been found by others (Mercer, 2000; Mercer & Littleton, 2007; Nystrand et al., 1997, 2003; Pontecorvo & Girardet, 1993). Howe and Abedin (2013) argue that, although dialogically organised classroom talk in small-groups is positive for children learning, there is still limited quantitative evidence to what extend "whether certain modes of organisation are more beneficial than others." (Howe & Abedin, 2013, p. 325) van der Veen et al. (2017) discuss Howe and Abedin' (2013) claim drawing on a study with 21 teachers and 469 children. They found robust evidence suggesting that dialogically organised classroom talk is more beneficial than non-dialogical classroom talk for the development of students' communicative skills.

Empirical findings from peer-group interaction studies demonstrate the existence of relationship between students' interaction and problem-solving success (Asami-Johansson, 2021; Howe et al., 2007; Liu & Tsai, 2005; Veenman et al., 2005). When students are required to explain how to solve a problem, they need to identify the main components of the problem, make cognitive connections with their own mental schemes about those components, and develop their own strategies to find a correct answer (Cooper, 1999; Webb et al., 2009). This process has been examined in studies about argumentation (Baker, 2009; Krummheuer, 1995; Schwarz, 2009).

Indeed, various research studies demonstrate the importance of speech in the learning process (Alexopoulou & Driver, 1996; Boyd & Markarian, 2011; Mercer et al., 2009). When students collaborate in small groups and talk, dialogue provides the opportunity for participants to explain, recognise, clarify and fill the gaps in their own understanding (Kaufmann, 2019). According to some researchers, elaborated or sophisticated explanations impact on students' understanding, and facilitate and encourage learning, and promote achievement (Cooper, 1999; García-Carrión, 2015; Shahrill & Clarke, 2015; Webb et al., 2009). Instead of passively accepting the teacher's explanations, students participating in small group peer dialogue can develop their own understanding on the topic through the process of peer discussion and interaction (Bakker et al., 2015; Liu & Tsai, 2005).

Research studies also point out that students often do not engage in productive talk. Galton and Williamson (2003) found that just putting several children sitting together in a group does not mean that they will engage in a fruitful collaboration. In fact, students' in-class conversation is often about non-school topics (Alexander, 2001). Episodes of potential fruitful dialogues emerge from time to time during the lesson. However, the dialogue can also be monopolised by one of the members within the group, who dominates the discussion imposing his or her points of view, whereas the other members of the group become "increasingly quiet and subdued, or they participate marginally" (Littleton & Howe, 2010, p. 275) in the conversation. However, less is known about the kinds of interaction among students that constitute effective collaboration, and which result in successful learning (O'Donnell, 2006). Hence, understanding those kinds of peer conversation emerging during small group collaborative activities may be important for identifying what kind of student-student talk leads to learning.

In this article, we draw on Soler and Flecha's (2010) previous work on the analysis of individuals' speech acts and dialogic learning, to discuss the types of talk in which participants in small-group peer collaborative work engage, and their connection with opportunities for academically productive learning.

2. Methodology

2.1. Research questions

The inquiry in this article is motivated by previous studies which suggest that not all types of interaction may lead to a fruitful, productive, episode of learning (Alexander, 2001; Díez-Palomar & Olivé, 2015; Galton & Williamson, 2003; Littleton & Howe, 2010). If we can assume this statement as true (based on the evidence discussed by others), then a useful research aim could be to determine what signs or indicators may characterise students' talk to identify different types of student-student interaction that are conducive to learning. The research questions underpinning this study are:

(a) What different types of interaction can be characterised during small group work?
(b) Is there any association between the type of interaction and the correctness of the answer(s) provided by the students?

2.2. Description of the case

In this article, we present a case study (Flyvbjerg, 2006; Yin, 2011). This case study aims to identify different types of interaction happening during a session of collaborative work in which four students engage, discussing to what extent can we identify trends between the type of interaction noticed and the correctness of the answer(s) provided by the students. We do not expect to generalise our findings but to find hints of potential relationships between both dimensions. According to Denzin and Lincoln (2011), case studies are one of the preferred methods to explore in-depth from multiple perspectives the complexity and uniqueness of social phenomena such as interactions within a micro-environment as a small group work setting. For this reason, we decided to use a case study restricted to the analysis of one group of students to identify types of interaction and potential relationships to be discussed in subsequent studies.

2.3. Data collection

The data for this study came from the *Social Unit of Learning* project, led by Prof. David Clarke at the International Centre for

Classroom Research (ICCR) at The University of Melbourne (Chan, Clarke, & Cao, 2018). Intact classes of Year 7 students (24 to 26 in a class) with their usual mathematics teacher from a school in Melbourne were invited to the university to complete collaborative problem-solving activities within a laboratory classroom. The laboratory classroom is equipped with 10 built-in cameras and up to 32 audio inputs.

In one session configuration, the students were asked to solve a set of three open-ended mathematics problems: the first task was completed individually, the second task in pairs, and the third task in small groups (four to six students in a group). The project design can be seen as more akin to design experiments (Cobb et al., 2003) which involve "both 'engineering' particular forms of learning and systematically studying those forms of learning within the context defined by the means of supporting them" (p. 9). The core classroom elements preserved through this project design were the existing teacher-student and student-student relationships. Although the students have not previously attempted the tasks used for the filming session, we consulted with their mathematics teacher prior to the session to ensure the suitability of the task for the students. The activities of each group were filmed using a designated video camera and microphones, with the student written product collected at the end. After the filming, the video data were transcribed and checked for accuracy. In order to maintain the research focus on student-student interaction, the teacher was asked to explain the task instructions to the students but not to teach the students how to complete the tasks.

Previous research suggests consistent evidence that open-ended problems provide an excellent opportunity for students to elaborate on their own approaches to the problem, engaging in mathematical productive talk (Chan, 2005; Cohen, 1994; Langer-Osuna et al., 2018). For this reason, the research team decided to use items based on open-ended problems. The small group problem which formed the focus of the current analysis was:

> Fred's apartment has five rooms. The total area is 60 square metres. 1) Draw a plan of Fred's apartment. 2) Label each room and show the dimensions (length and width) of all rooms.

The research team decided to focus the analysis on the talk produced by each group participating in the session. Therefore, a group of four students was selected randomly among all the groups participating in the session for the analysis discussed in this article. The group chosen was formed by two girls and two boys with the pseudonyms of Anna and Pandit, and Arman and John respectively. All of the students spoke fluent English except John, who has recently arrived in Australia from China and used spoken Chinese from time-to-time during the session.

2.4. Data analysis

In order to analyse the data, *interactional events* (IE) were used as the unit of analysis in this study. An IE is defined in terms of a topic (Table 5). Students engage in a group discussion around a particular topic (for instance, "size", "shape", etc.). They exchange arguments, points of view, claims, etc., around this topic. Sometimes, it could be also the case that students insert comments that do not have anything to do with the topic of discussion and go back to the main topic of discussion later on. We consider an "interactional event" the whole set of turns-taking around a particular topic of discussion. It starts with a query of one of the participants. It ends either when the participants answer that question or when the participants share no further comments regarding that question in that dialogue. All IEs were coded using the four dimensions displayed in Table 1: type of talk, illocutionary force, correctness and recognition of the error.

To analyse the student dialogue, we drew from Mercer's classification of "cumulative", "disputational" and "exploratory" in types of talk (Mercer & Littleton, 2007; Vrikki et al., 2019). We refined this taxonomy using Austin's (1962) concept of illocutionary force of the statement used by the participant in any interactional event (García-Carrión & Díez-Palomar, 2015), as defined by Soler and Flecha (2010). Each utterance was considered in terms of its illocutionary force (consensus/coercion) to identify the type of interaction according to the coding scheme. Discussion among authors resulted in a redefinition of García-Carrión & Díez-Palomar (2015) classification, introducing a "half-way" situation in between "consensus" (which is the main component of what they call "dialogic talk") and "coercion" (which characterises what they call "non-dialogic talk"), to deal with interactional events where participants are neither engaging in dialogue looking for consensus drawing on the use of validity claims, nor imposing their will with imperative force

Table 1
Summary of the coding scheme to analyse the data.

Type of talk	Non-dialogic (ND)	Type 1	Conative (T1)
		Type 2	Declarative (T2)
		Type 3	Referential (T3)
		Type 4	Expressive (T4)
		Type 5	Phatic (T5)
		Type 6	Inquiry (T6)
	Dialogic (D)	Type 7	Argumentative (T7)
Illocutionary force	Consensus (Co)		
	Coercion (Ce)		
	Neutral (N)		
	Expressiveness (E)		
Correctness	Correct (Cor)		
	Non-correct (NCor)		
Recognition of the error	Recognition (R)		
	Non recognition (NR)		

Table 2
Types of talk: definitions and examples.

	Definition	Example utterances
Non-dialogic talk		
Type 1: conative	The speaker makes a claim, a statement, or an assertion using his/her/their power position as a warrant to justify that claim. The *illocutionary force* of conative statements is coercion.	"Let's make the house base 60 metres."
Type 2: declarative	The speaker makes a claim, a statement, or an assertion. There is no warrant to justify that claim. The *illocutionary force* of declarative statements tends to be neutral, although it could also be consensual.	"It's 60 meters square." "We agree on your work."
Type 3: referential	The speaker shares and exchanges particular information. The *illocutionary force* of referential statements is neutral.	"It just has five rooms."
Type 4: expressive	Express the speaker's attitudes and emotions towards a claim, statement or assertion. The *illocutionary force* of expressive statements is expressiveness.	"Oh my God, what are you doing?!"
Type 5: phatic	The purpose of the statement is social, in the sense of provoking, or following up, the conversation. The *illocutionary force* of phatic statements is neutral.	"Huh, what?"
Type 6: inquiry	The speaker asks a question. The *illocutionary force* of inquiry statements can be consensus (when the speaker is looking for additional warrants to justify someone's previous claim), coercion (when the speaker is trying to impose his/her own will drawing on a previous power claim), or neutral.	"How big do you want the house to be?"
Dialogic talk		
Type 7: argumentative	Makes a claim, a statement, or an assertion using validity claims as a warrant to justify his/her/their claim. Validity claims include conjectures, reasoning, and proof. Participants may draw on academic skills or everyday skills. The *illocutionary force* of dialogic statements is consensus.	Student 1: "Why do you want to change [the scale]? Why can't you just make it one centimetre?" Student 2: "Because it's going to be too small."

(coercion) using power claims. This situation was coded as "neutral" in terms of the illocutionary force. Finally, the authors also noticed some utterances expressing an emotional state of the speaker, who was neither looking to reach a consensus, nor to coerce. This type of talk was defined as "expressive interaction", where the illocutionary force is expressiveness.

Peer debriefing was conducted with the research team to examine the validity of the coding scheme (Lincoln & Guba, 1985). After debriefing, the authors concluded that non-dialogic talk can be a broad category containing different kinds of talk, based on the intentionality of the speaker (illocutionary force), but also on the function of the language (Jakobson, 2014). As a consequence, non-dialogic talk was split into six different sub-categories, according to illocutionary force and language function: conative, declarative, referential, expressive, phatic and inquiry, as defined in Table 2. Dialogic talk remained as a unique category (without sub-categories) since the illocutionary force, by definition, is always "looking for consensus", and the function of language is justifying (in order to reach that consensus) drawing on validity claims (in Habermas' and Flecha's terms). This category was labelled as Argumentative (Type 7).

The difference between dialogic and non-dialogic talk remains in the fact that "dialogic talk" assumes that the speaker provides some kind of argument that can be verified by the rest of the participants in the discussion (in other words, the speaker justifies his/her claims using "validity claims": claims for truth, rightness and truthfulness). The speaker pretends to reach a consensus with the rest of the participants in the discussion, drawing on the agreement on the arguments shared. Conversely, "non-dialogic talk" occurs when the speaker does not explain the reasons for sustaining his/her claim. The speaker may either impose his/her own will or declines to provide any warrant to justify his/her claim. In any case, since there is an absence of a claim which can be verified (or not) by the participants in the discussion, we cannot classify this type of interaction as "dialogic."

To establish inter-coder reliability, two researchers coded 100% of the data. According to O'Connor and Joffe (2020), a minimum of two independent coders is necessary to guarantee inter-coder reliability. Tables 3 and 4 summarise the analysis of the reliability of the coding scheme for items "type of talk" and "illocutionary force."

Results suggest a high consistency in the analysis of the transcript. Regarding the "type of talk", there is an ICC_A equal to 0.974 (IC 95%: 0.964 to 0.982) with a $p < 0.001$; whereas for "illocutionary force", the ICC_A is equal to 0.993 (IC 95%: 0.990 to 0.995) with a $p < 0.001$, which indicates that coders were even more consistent when coding the type of force among the IEs.

To address the second research question, we added an additional dimension in our analysis: the correctness of the answer provided/constructed by the participants in the small group discussion (Table 1). According to Howe et al. (2007), students improve their learning when working in group-work settings. Their study findings suggest that group-work plays a critical role in students' understanding of academic concepts. The study assumed that students' understanding is associated with the correctness (or incorrectness) of their statements. Drawing on this idea, we noticed that students in our focal student group invoke the idea of "correctness" when they want to warrant their arguments. Participants in the small group may propose potential answers to the original task during the task activity, before reaching consensus in the final product (final written solution submitted). Answers may be correct or incorrect. The authority to define them as "correct" or "incorrect" can be based on "mathematics." Correctness corresponds to claims which can be verified by its "rightness" in mathematical terms (i.e., six times ten is a correct answer to calculate the area of a rectangle). However, sometimes we also found other sources of authority of what participants will consider "correct" or "incorrect," based on "agreement." Agreement refers to a situation in which participants have the same opinion, or in which they approve of or accept something. Participants may use different types of warrants, for instance: socio-cultural assumptions, every day previous knowledge, etc. For instance, everyone in a group may agree on 'rectangle' as a shape for Fred's apartment, and 6×10 to represent its size, because "apartments should look like rectangles," although other shapes and other representation of the size may be also correct for an apartment, such as 'a 12×5 rectangle', or a non-regular trapezoid. In those cases, "correctness" goes beyond what is strictly mathematical (because several answers mathematically correct are possible), towards an "agreement" dialogically accepted by the students participating in the IE. Sometimes discussion around incorrect answers may lead participants to recognise their error(s), giving them the opportunity to propose new answers fixing the error identified. For this reason, we also decided to add a fourth dimension (recognition of the error) to our coding scheme (Table 1).

Table 3
Analysis of the inter-coder reliability. Item: *Type of talk*. Interclass correlation coefficient.

		95% confidence interval		F test with true value 0			
	Intraclass correlation[b]	Lower bound	Upper bound	Value	df1	df2	Sig.
Single measures	0.950[a]	0.931	0.964	39.077	135	135	0.000
Average measures	0.974[c]	0.964	0.982	39.077	135	135	0.000

Two-factor mixed effects model where the effects of people are random, and the effects of measures are fixed.

[a] The estimator is the same, whether or not the interaction effect is present.

[b] Correlation coefficients between classes of type C using a definition of consistency. The intermediate measure variance is excluded from the variance of the denominator.

[c] This estimate is calculated assuming that the interaction effect is absent, because otherwise it cannot be estimated.

Table 4
Analysis of the inter-coder reliability. Item: *Illocutionary force*. Interclass correlation coefficient.

		95% confidence interval		F test with true value 0			
	Intraclass correlation[b]	Lower bound	Upper bound	Value	df1	df2	Sig.
Single measures	0.985[a]	0.979	0.989	134.701	134	134	0.000
Average measures	0.993[c]	0.990	0.995	134.701	134	134	0.000

Two-factor mixed effects model where the effects of people are random, and the effects of measures are fixed.
[a] The estimator is the same, whether or not the interaction effect is present.
[b] Correlation coefficients between classes of type C using a definition of consistency. The intermediate measure variance is excluded from the variance of the denominator.
[c] This estimate is calculated assuming that the interaction effect is absent, because otherwise it cannot be estimated.

3. Results

3.1. Analysis of the students' interactions in the interactional events drawing on the type of talk

We examined in what kinds of interaction students engage during their discussion about an open-ended problem. This analysis revealed some patterns of interactions. The segment analysed began with the teacher introducing the *Fred's apartment* problem. The students were informed that they had 15 min to work together in small groups and each group needed to provide a single solution to the problem. The teacher made no further public statements after he read out the problem to everyone. The teacher distributed the worksheet among the students and provided one copy of the task worksheet to each group. Anna (girl), Pandit (girl), John (boy), and Arman (boy) were in the same group and formed the focus of the analysis. Seven IE were identified based on the group's transcript (see Table 5).

The group members engaged in a lively discussion that, finally, lasted for 25 min. During the analysis of the video record, we noticed that Anna and Pandit mainly dominated the interaction, whereas John and Arman were mostly in a peripheral position, even though John was actively trying to find a way to solve a task (see Table 6). He talked and muttered to himself at times (sometimes in Chinese, his native language), trying to find a strategy to solve the task. Arman was in and out of the conversation, not paying attention to the task for most of the time.

Regarding the results about the analysis of the type of talk used by the students participating in this small group, Table 7 summarises the percentage of different types of talk used by them during their collaborative work. As explained in the section about the data analysis (Table 4), we used a multilayer analytical approach involving four different dimensions (type of talk, illocutionary force, correctness and recognition of the error).

The most predominant type of talk was non-dialogic (94.1%). The participants engaged a few times in dialogic talk, especially in Event 2 (when talking about the scale of the drawing) and Event 5 (in which we found a remarkable misunderstanding about area and perimeter by the students, hence the students engaged in a discussion to clarify the difference between these two mathematical objects). The data also reveal a large frequency of incorrect answers during the process of solving the task. Over the 64.9% of the time (percent of utterances) Pandit, Anna, John and Arman came up with a wrong answer, whereas in 35.1% of the cases they came up with a 'correct' answer. That is especially the case for IE#2 (The scale of the apartment drawing) and IE#4 (The size and shape of Fred's apartment), in which the "non-correct" answers are 80% and 100% respectively. This is consistent with previous research in mathematics education (Huu Tong & Phu Loc, 2017), suggesting that solving a task is a complex process, in which participants may come with partial (not always correct) answers. They may accept or reject them as 'suitable answers' based on the arguments hold by one (or some) of the participants in the collaborative work.

The most prevalent illocutionary force among participants' contributions within the discussion was "neutral" (49.6% of the turns). "Consensus" is the second most frequent illocutionary force (23.7%). Interactional events #2 and #6 are the ones in which "consensus" presents occurred almost half the time (47.1% and 50% respectively). Regarding the second interactional event (focused on the discussion about the scale of the apartment drawing), Table 7 shows that students mainly used "inquiry" (29.4% of the turns) and "argumentative" talk (17.6% of the turns); which is consistent with our approach. However, in the sixth interactional event, half of the students' participation had a consensual component, although the prevalent type of interaction was non-dialogical, that is: 95.2% of the turns. Non-dialogical talk is primarily associated with either coercion or neutral illocutionary force. Looking at the transcript, we found that students engaged in a dialogue using inquiry talk (33.3%) and declarative talk (57.1%) to show agreement: Arman declared

Table 5
The focus of the group discussion for each interactive event (IE).

IE#1: Deciding on a shape for Fred's apartment
IE#2: The scale of the apartment drawing
IE#3: How big are the rooms in Fred's apartment?
IE#4: The size and shape of Fred's apartment
IE#5: Is perimeter the same as area?
IE#6: Deciding on the types of rooms in Fred's apartment
IE#7: Seven rooms are… too many rooms!

Table 6
Proportion of participation within the group (in number turns).

Name	Frequency
Anna	31.8%
Arman	16.6%
John	16.6%
Pandit	31.8%
Teacher	3.2%

Table 7
Percentages of the distribution of talk type (in number turns), disaggregated by subcategories of talk type.

	Type of talk							Illocutionary force				Correctness		Recognition of the error	
	Non-dialogic						Dialogic								
	T1	T2	T3	T4	T5	T6	T7	Co	Ce	N	E	Cor	NCor	R	NR
IE#1	31.6	21.1	0.0	10.5	10.5	26.3	0.0	21.1	31.6	36.8	10.5	66.7	33.3	–	–
IE#2	23.5	23.5	0.0	5.9	0.0	29.4	17.6	47.1	23.5	29.4	0.0	20.0	80.0	25.0	75.0
IE#3	0.0	62.5	0.0	12.5	6.3	18.8	0.0	6.3	0.0	87.5	6.3	100.0	0.0	–	–
IE#4	17.2	27.6	3.4	10.3	17.2	20.7	3.4	17.2	17.2	48.3	17.2	0.0	100.0	50.0	50.0
IE#5	0.0	33.3	0.0	6.7	26.7	13.3	20.0	26.7	0.0	40.0	33.3	100.0	0.0	–	–
IE#6	0.0	57.1	0.0	0.0	4.8	33.3	4.8	50.0	0.0	45.0	5.0	–	–	–	–
IE#7	9.1	50.0	4.5	0.0	18.2	18.2	0.0	0.0	13.6	68.2	18.2	0.0	100.0	50.0	50.0
Total	12.5	37.5	1.5	6.6	12.5	23.5	5.9	23.7	13.3	49.6	13.3	35.1	64.9	44.0	56.0

Note: in each row, 100% is counted for each IE, except for the last one, where 100% is calculated for all IE at the same time.

several times that he agreed with the girls' proposed answer ("We agree with your work"). Consensus, hence, emerges as indicator of agreement, in that situation.

Table 8 displays the association between "correctness" and "type of talk." The correct utterances are declarative talk (69.2%), or "argumentative talk" (30.8%). Instead, when we analyse the result of "non-correct" statements, we can find more types of talk involved. Our data reveal that "Dialogic talk" (which includes argumentative talk) appears 8.3% of the turns among all the utterances coded as "non-correct" statements, whereas the 91.7% represents the times when "non-dialogic" talk (adding conative, declarative, referential, expressive, phatic and inquiry) appears to be non-correct.

During the task discussion, the students were also able to identify their own mistakes when trying to elaborate coherent potential answers. Table 9 shows the distribution of the "Recognition of the error" by the type of talk. We can see that when students use "inquiry talk", they are more likely to recognise their errors (36.4%) than when using other types of talk (such as "conative talk", with a 9.1% of the turns recognising the error). Using "declarative talk" is also associated to a lesser chance to recognise the error, as suggested by the data (36% of the turns students using "declarative talk" are not prone to recognise their errors). Declarative talk is defined as "claims missing any warrant that justifies them" (as presented in Table 1). Thus, "having to justify" a claim seems to be a crucial cognitive component of the learning process in building a correct answer to a task.

Most of the times the students use "non-dialogic" talk, that is, the sum of conative, declarative, referential, expressive and phatic types of talk (94.1% of the turns, as displayed in Table 7). Almost half of the turns (49.6%) the illocutionary force was neutral. The most common type of talk was "declarative" (37.5%). That suggests that students participating in this working group were more likely to make declarative statements in their discussion, with no other intentionality than contributing to the collective work. Conative, expressiveness, and inquiry, appear to emerge in particular situations, when disagreement and confrontation among the students emerged. However, this claim needs to be discussed qualitatively. In next section a qualitative analysis of selected IEs is provided, in order to further discuss this tentative statement.

Table 8
Proportion of talk types (in number turns) based on correctness.

Type of talk	Correct	Non-correct
Conative (T1)	0.0%	25.0%
Declarative (T2)	69.2%	37.5%
Referential (T3)	–	–
Expressive (T4)	0.0%	4.2%
Phatic (T5)	–	–
Inquiry (T6)	0.0%	25.0%
Argumentative (T7)	30.8%	8.3%
Total	100.0%	100.0%

Table 9
Proportion of talk types (in number turns) based on recognition of the error.

Type of talk	Recognition	Non-recognition
Conative (T1)	9.1%	24.0%
Declarative (T2)	18.2%	36.0%
Referential (T3)	–	–
Expressive (T4)	18.2%	8.0%
Phatic (T5)	–	–
Inquiry (T6)	36.4%	24.0%
Argumentative (T7)	18.2%	8.0%
Total	100.0%	100.0%

3.2. Qualitative analysis of the interaction among participants in the events

In order to examine students' type of interaction, we analyse how they solve different aspects of the problem paying attention to their dialogues. Several excerpts belonging to the seven IEs identified are chosen to illustrate what types of interaction can be identified in the students' interaction. In the analysis we noticed the emergence of some patterns of interaction.

3.2.1. Deciding on a shape for Fred's apartment (IE#1)

After the task was presented to the class by the teacher, the four students began to discuss the potential shape for Fred's apartment (first IE). They used the information from the task as a starting point for their discussion. Pandit was inquiring ("inquiry talk") about the size of Fred's apartment, and Anna responded by saying that Fred's apartment must be of 60 square metres (as the stated in the task instruction). Pandit further asked about the size in terms of length and width (working on a sheet of paper, looking for how to draw Fred's apartment on that piece of paper). Anna said, "I'll decide" ("conative talk"), stopping Pandit's first attempt to draw Fred's apartment on the sheet of paper. Anna said, "It's a square." No additional explanation, nor justification, was added to that statement, giving no space for any additional discussion on Fred's apartment shape with the other group members.

Pandit: (drawing on the working out sheet) Wait. It's going to be like, wait…
Anna: No, guys.
Pandit: … how big do you want the house to be?
Anna: It's 60 meters square.
Pandit: Sixty square meters.
Arman: (holding up a ruler) It's… (to John) Measure your hand.
John: (to Arman) What?
Anna: That's like…
Pandit: How big do you want? Like the length and width?
Anna: (takes over the working out sheet from Pandit and starts to draw on the sheet) Okay. I'll decide.
Pandit: (to John and Arman) Guys, listen.
Arman: Okay. This is…
John: (reading the task instruction projected in the front of the room and starts to write on his own working out sheet) … Take a pair.
Pandit: (watches Anna's drawing on the sheet) My God, what are you doing?
Anna: What?
Pandit: Why are you changing it …
Anna: It's a square.
John: (Arman starts to write on John's working out sheet. John points to the pile of blank sheet on the table.) Take a new one.
Arman: (to himself or to John) Why, why, why?
Pandit: Don't do square. Why make it a square house?
Anna: Why, why?

As we can see in the excerpt, Anna determined that the apartment should be a square, but Pandit answered by asking, "why make it a square house?" Pandit was using a non-dialogic inquiry type of talk, that can be seen as looking for consensus (asking Anna for a justification of why Fred's apartment shape had to be a square). During the whole IE, we cannot find any utterance suggesting a justification for Anna's decision on the shape. She just stated: "I'll decide," without adding any additional explanation and, perhaps, restricting other students to make a different proposal (which includes a component of *coercion*). Despite Pandit trying to ask Anna for additional reasons that the shape of Fred's apartment must be a square, Anna maintained her decision. She even questioned Pandit's objection, asking "why, why?" That IE was resolved without reaching any consensus about Fred's apartment shape.

3.2.2. The scale of the apartment drawing (IE#2)

The four students discussed what scale they should use to draw the blueprint of Fred's apartment on the worksheet. This IE started as a dialogic interaction as the students were negotiating (looking for consensus) whether that scale was suitable or if it needed to be changed. Anna wanted to change the scale of the drawing. She decided to use 2 $cm^2 = 1\ m^2$. Pandit contended that they could not

change it. Anna explained the scale that she wanted to change to. Arman commented that the sheet of paper was actually *too small* to use that scale. The words "too small" are considered as a valid claim that Arman was using to justify his position in this IE, because instead of opposing what Anna said, he used a reason to justify his disagreement. The validity of that claim is based on Arman's subjective perception of the size of the drawing.

Anna: Guys, let's actually change the scale.
Pandit: We can't.
Anna: Why not?
Pandit: We're not allowed to change.
Anna: You are. Let's make two-centimetre square equals one metre.
Arman: (singing to himself) Fred's house. Do - do - do - do - do - do… The paper is too small.

The discussion continued as Pandit complained that the scale that Anna proposed (2 cm^2 to 1 m^2) was "so confusing". However, Anna replied that she just wanted to use that scale (although Pandit said she found it confusing, and Arman claimed that the paper was not going to be big enough to contain the full drawing). Anna did not add any other explanation, nor justification, to her decision, not being open to discussion. Instead, Anna replied "Because I want to", suggesting that she did not intend to create a dialogic situation to reach a consensus with the other group members. The illocutionary force of Anna's claim was coercion. She was using the conative talk.

Pandit: No, don't do that. That's confusing.
Anna: Why not?
Pandit: Why do you want to confuse?
Anna: Because I want to.

Pandit persisted in questioning Anna's proposal since she was not happy with it. That forced Anna to move towards a dialogic interaction.

Anna: (To the group) Let's make two centimetres - guys, let's make the two-centimetre square one metre square in this, okay?
Pandit: Don't – don't. It's so confusing.
Anna: Why not? How is it confusing? You just double it.
Pandit: Why do you want to change? Why can't you just make it one centimetre?
Anna: Because it's going to be too small.
Pandit: It's okay.

Anna refuted Pandit's comment ("It's so confusing") by saying that her proposal merely involves doubling the scale used in the drawing from 1 cm^2 to 2 cm^2. However, Pandit was still not convinced. She questioned again why Anna wanted to use two square centimetres instead of "one [square] centimetre" as the scale. This forced Anna to further justify herself ("because it's going to be too small"), even though she did not appear to have any empirical support for her assertion. She put forward a claim based on her intuitive understanding of "size." The 'back and forth' questioning and justification between Pandit and Anna indicates that the two girls wanted to reach a consensus when solving the task ("dialogic talk").

3.2.3. How big are the rooms in Fred's apartment? (IE#3)

The students realised that Fred's apartment was small. John suggested that each room in the apartment can be 12 square meters (area). The conversation illustrates dialogic talk since the students were looking for valid reasons to reach a consensus about the size of the rooms.

Anna: (To Pandit) How… how big will we make the room? Maybe two metres and…
Pandit: (To Anna) They (Arman and John) are not even looking.
Arman: (Talking to himself) One, two, three, four, five, six…
John: I think there are 12 area.
Arman: … seven, eight, nine.
John: No.
Anna: No, no. I mean the rooms.
John: Yeah. I think it's twelve. Each room the area is twelve.
Arman: One, two, three, four, five, six, seven, eight, nine, ten.
John: □□□□□□□□□□□□□?(In Chinese "That's strange. Which one should be calculated?")
Arman: Ha… That's not equal. That's not equal.
Anna. Okay.
Pandit: Guys.
Arman: Chu-chu. Ouch.
John: Meter. □□□□□?(In Chinese "How to write 'sixty'?")
Ana: Doesn't matter.
Pandit: Oh my god.
Anna: The house is super small. (Reads the task instruction projected in the front of the room)
John: (Laughs)

Anna: Wait a minute. Oh it's 60 square metre, okay.
John: Area.
John: Yeah. I think so it's twelve area for each room.

In the transcript, there is no explicit evidence about how John realised that each room has to be 12 m^2. He was considering that if the apartment must be 60 m^2, then the "missing factor" to make this statement true (___ times 5 = 60) is 12. Here we can interpret that John probably had a formal understanding of multiplication and division as complementary algorithms. In fact, he divided 60 with 5 to obtain 12 on his sheet of paper. He was able to work it out, but he did not explain this to the group (and the group, aka Pandit and Anna, did not accept it).

3.2.4. The size and shape of Fred's apartment (IE#4)

While John was working on the size of the rooms on his own, Anna and Pandit were thinking about the length and the width of the apartment. They decided to create a "square" that is 30 m length and 20 m width.

Anna: Let's make the house base 60 metres.
Arman: Total area of 60 square metres. Infinity.
Pandit: How big do you…?
Anna: So, should we make it 20 and 30?
Pandit: This is…
Anna: Wait. Let's just say that's - no, Pandit, it won't work.
Pandit: It does. It does.
Anna: It doesn't. We have to get a 30 there and then look, up to there is 30. Do you have a brain?
Pandit: (laughs) I have a brain.
Arman: Oh wait, wait, wait.
Pandit: No. Wait, isn't that has to times?
Anna: Yeah.
Pandit: Twenty times 30 is like 600.
Anna: Six hundred.
Pandit: It has to be 60.
Anna: Yeah.
Pandit: You did it wrongly. That's why.

The students discovered that 20 times 30 is not 60, but 600, which does not fit in with the task constraint of 60 sqm. The students used multiplicative reasoning to figure out the error. In this case, the dialogic interaction first leads the students towards a wrong result (that 20 times 30 could correspond to a 60 m^2 apartment); but then, the necessity to justify that result was also the way for them to realise that actually, they were wrong. Pandit noticed that "it has to be 60" (not 600). They were doing their "maths" to find a suitable

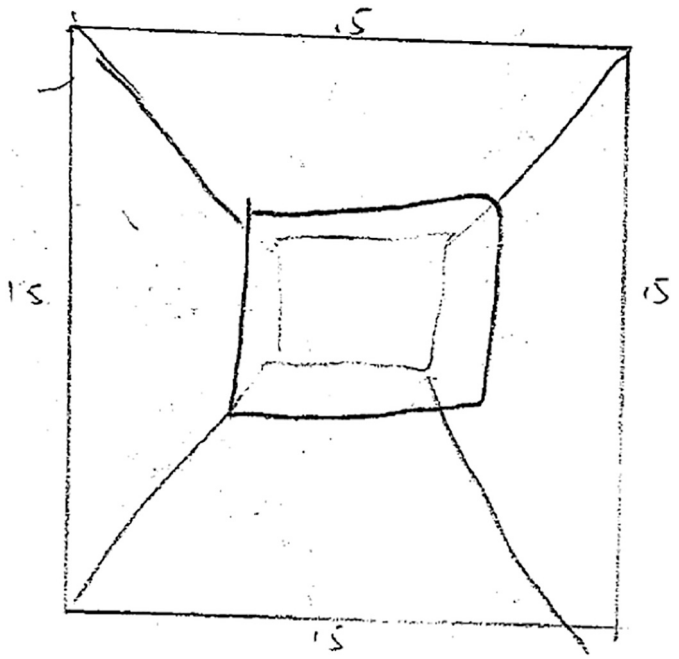

Fig. 1. Drawing of Fred's apartment.

justification of their first claim (which means that they were looking for a valid claim using multiplication as a warrant to justify it). Then, after agreeing that 20 times 30 is not a suitable answer, the students explored further alternatives to set the size of the rooms in Fred's apartment.

3.2.5. Is perimeter the same as area? (IE#5)

John drew a picture of a square of 15 m on each side (see Fig. 1). He assumed that fifteen times four equals sixty (where 60 is the area for Fred's apartment, according to the problem specification). But, in fact, John confused perimeter with area.

Arman questioned John's answer not by pointing out that perimeter is not the same as area, but by noting that 15 times 4 is 60, and Fred's apartment has five rooms, hence 15 m does not appear to be a good answer as the length of the square apartment.

Arman: (to John)… John. Fifteen times four is 60 and 15 times five is 75.
(…)
Arman: Fifteen times five is 75 and 15 times four is 60.
John: Huh? What?
Arman: Fifteen times four is 60, but we need five rooms. Five, five.
Anna: Twenty-three. Twenty- no, no, no.

The first thing that Arman noticed was the fact that John's answer was so confusing. However, it seems that Arman was not aware of John's confusion between perimeter and area. Rather, Arman used a different way of reasoning, using the side to justify for the area of five rooms. He noticed that fifteen times four is sixty, but fifteen times five is seventy-five, which was not the correct answer to the problem since Fred's apartment had five rooms. Then, fifteen was not a 'good' number to divide the size of the shape (in the boys' terms).

3.2.6. Deciding on the types of rooms in Fred's apartment (IE#6)

In the next IE, the students discussed the types of rooms, their size, as well as some components of the drawing, such as the

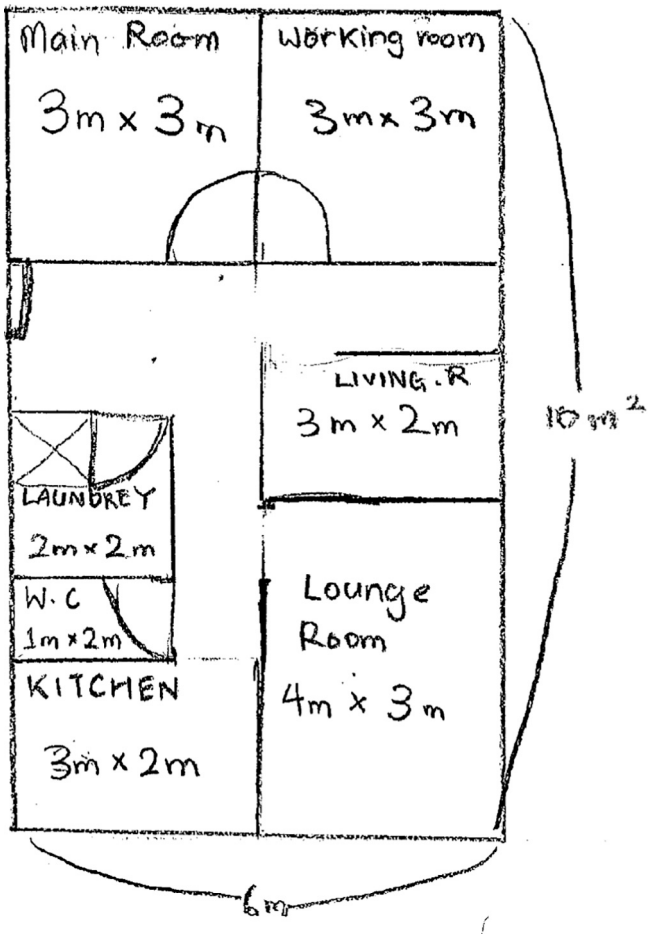

Fig. 2. Final answer of this group of students.

representation of the doors. Anna and Pandit led the discussion, drawing on their own background knowledge to justify the inclusion of the different types of rooms they proposed. Non-dialogic talk dominated the conversation between Anna and Pandit, since the source of legitimation for their statements are not validity claims in Habermasian terms, that is: a set of arguments that could be verified by others because of its "truth, rightness, appropriateness or comprehensibility (or well-formedness)" (Habermas, 1984, p. 39). Instead, Anna and Pandit were using claims based on their personal preference for a particular kind of room, or because "it is like in my home." For instance, Pandit justified that she wanted to include a laundry next to the kitchen because "my laundry's like connected to the kitchen."

John: How to label the… each room?
Anna: Toilet, kitchen.
Pandit: What do you guys want?
John: How to label each room?
Arman: We agree with your work.
Anna: Laundry, laundry.
Arman: We agree with your work.
John: How to label each room?
Anna: That's nice, just go with …
Pandit: What is he (John) talking about?
Anna: I don't know.
Pandit: Next to the toilet is the laundry.
Anna: Yeah. But then you go in and it's straight into the laundry?
Arman: Ah.
Pandit: Oh. No. My laund…
Anna: That's a bit strange.
Pandit: … my laundry's like connected to the kitchen.
Anna: Okay, okay. I don't care.

3.2.7. Seven rooms are… too many rooms! (IE#7)

The students continued discussing the types of rooms in the apartment, adding more and more rooms to their drawing. They produced the drawing shown in Fig. 2. However, John disagreed with Anna and Pandit (and also with Arman, who often appeared to be distracted and playing during the problem-solving activity). The excerpt below corresponds to the final IE where John expressed his disagreement with Anna and Pandit's solution to the task. John sought the teacher's approval, but the teacher maintained his role as a facilitator (not an instructor). Then, John asked again "can we draw seven room?", and Pandit answered "You can make as many rooms as you want." John seemed to give up on the discussion. For example, he did not quote the original task instruction to support his argument. Instead, at the end of the excerpt, after Anna and Pandit decided on the drawing of Fig. 2 as their final solution, John asked for the ruler and tried to produce a different answer by himself. But time ran out for him to complete what he was doing.

John: There're six rooms. Toilet, kitchen.
Arman: Pee, pee.
John: … that is kitchen. No more…
Anna: We're are done.
Pandit: We're done Mr. B.
[…]
Teacher: You need to give the best answer you can at the moment. I'm not going to tell you if it's right or wrong.
John: Can you draw seven room?
Teacher: There's lots of answers, there's a lot - there are many possible answers to this question, okay. You just need to give the best answer that you can and one that everybody in the group is happy with.
[…]
Arman: Yeah, that's good.
John: Can we draw the seven room?
Teacher: Pardon?
John: Can we draw the seven room? One - One, two, three, four, five, six, seven. Can we?
Pandit: Wait. You can make as much rooms as you want.
Teacher: You just… you… you need to come up with a house that everybody in the… in the group's happy with, John. Alright?

4. Discussion

We have shown how the analysis of the talk produced in a collaborative small group work (unit of learning) setting may help us to define a tentative classification of different types of interaction that may facilitate the students' learning.

Previous studies have provided substantial evidence on the social nature of learning (Mercer & Littleton, 2007; Racionero & Padrós,

2010; Sfard, 2008; Voigt, 2013). Yackel et al. (1991) claimed that students working in small groups engage in interactions that give rise to learning opportunities that not typically occur in traditional classrooms because students engage in collaborative dialogue when trying to solve conflicting points of view. Cognition can be seen as distributed (Hutchins, 2000), and different scholars have analysed how individuals use collaborative argumentation to construct their understanding of facts (Mueller et al., 2012). By taking the opportunity to elicit an opinion from someone else in the group, or by utilising what has been said by extending it further, the participants in the discussion construct the meaning around the topic discussed, creating real learning opportunities (Barnes & Todd, 1977; Rommetveit, 1985). Evidence from interactions among Anna, Pandit, John and Arman are consistent with those previous findings. Their final answer to Fred's apartment is the result of a process of negotiation in which they are making meaning to the problem, deciding on crucial aspects to define Fred's apartment, such as "size", "shape", "types of rooms", etc. In so doing, they need to agree on how to distribute the 60 m^2, how to find a proper length and width for the apartment that fits this size, and how to solve conflicting aspects while working throughout the problem. Anna, Pandit, John, and Arman' interactions confirm that students working together in small groups benefit in terms of increasing their chances for learning, including transfer (from their socio-cultural background) and reasoning development (Clarke et al., 2015; Clarke et al., 2016; Littleton & Howe, 2010).

However, in this article, we examine collaborative small group interaction from a different angle: from the types of interaction that can be noticed among students' dialogue solving an open-ended problem. We aim to identify different types of interaction that may open the scope for further research to clarify if all types of interaction produce the same impact on students' effective learning, or not. Previous research has shown significant differences in how students participate in small-group peer work (Clarke, 2015; Clarke et al., 2016; Kelly, 2007). Studies about students' participation in dialogic discussions reveal that some participate more frequently than others in the dialogues (Clarke et al., 2016). This is also true in the case analysed here: Anna and Pandit monopolised the discussion, whereas John was mainly participating from the "boundary" (sometimes trying to get into the girls' discussion, some other times engaging in an "individual" talk -talking to himself-), and Arman was most of the times totally out of the discussion or holding a peripheral position in the dialogue, with John. Chi (2009) found a minimum threshold level of engagement for students to benefit from participating in a discussion group. Yackel et al. (1991) pointed out that "verbalisation" is a sine qua non requirement for students to benefit from participating in the discussion. They learn throughout the process of verbalising their answers to the task. This result confirms Vygotsky's (1978) findings as well. The same conclusion has been reached by other scholars many times (King, 1999). However, not all ways of participating in a group end in effective learning (or creating the opportunities for effective learning). Dealing with this challenge, authors have come with different concepts to examine when interaction in a small group of peers is effective (or it is not), such as *academically productive talk*, *accountable talk*, dialogic *talk*, *dialogic teaching and learning*, *dialogic pedagogy*, etc. (Clarke et al., 2016; Resnick et al., 2010).

In previous work, we have discussed the relevance of dialogic and non-dialogic talk on how students engage in productive interactional events (IE) (Díez-Palomar & Olivé, 2015; García-Carrión & Díez-Palomar, 2015). In this article, we move a step forward in identifying different types of talk in the dialogue among the students working together on a mathematical task. The contribution we want to bring up for discussion is the fact that we need to pay attention to the individual's intentionality when participating in a potentially productive talk. Participants in the dialogue have to want to reach a consensus on the answer to the proposed task, because, otherwise, it can appear the possibility for someone of the group to impose his or her point of view without offering any reason susceptible of verification by the rest of the participants in the group. If there is no possibility to reach an agreement by consensus based on the exchange (discussion) of validity claims, then it would be difficult for the participants in the group to construct meaning (learn) around the topic(s) discussed in the task (which previous works -Barnes & Todd, 1977; Rommetveit, 1985; Yackel et al., 1991- have already demonstrated that is a crucial aspect in the learning process). As Resnick et al. (2018) claim (when talking about the *accountable talk*), we need accountability in terms of reasoning, knowledge and learning community. In other words, dialogic learning needs that participants in the group to share reasons based on (potential) truthfulness, respecting each other's ideas and points of view, forming an authentic learning community. But, for this to happen, we think that participants in the group have to want to participate in this type of interaction. For this reason, we focus on the analysis of the intentionality drawing on the *illocutionary force,* thus we try to re-define interaction from this point of view. Anna, Pandit, John, and Arman engaged in multiple IEs during the learning episode reported in this article. However, not all of the IEs included *consensus* as illocutionary force, a main component of dialogic talk. Sometimes *coercion* or *neutrality* was the elements embedded in the IE. For example, the students decided to draw a square to represent Fred's apartment (IE#1). But this was mainly because Anna decided by herself the shape of the apartment (she said "I'll decide" using a conative statement) with no further explanation nor justification. Pandit immediately asked "Why, why, why?" seeking for a valid argument to accept (reach consensus) Anna's claim.

The type of illocutionary force becomes an indicator that appears to explain students' learning because coercion seems to reduce the opportunities of participants to engage in a productive dialogue through exchanging justification to defend their claims that potentially would lead them to expand their understanding on that topic, whereas consensus fosters learning for the opposite reason. For instance, in IE#1 Pandit, John, and Arman were not able to further discuss alternative shapes for Fred's apartment, because Anna already decided to draw a square, although other shapes are possible (i.e., trapezoid, rectangle, or any other regular or irregular polygon satisfying the condition of 60 m^2 as its area).

When Anna requested to change the scale of their drawing (IE#2), Pandit resisted, responding that "That's confusing". Anna replied that she wanted to change the scale, "Because I want to." Pandit was not satisfied with Anna's answer, hence it seems that the absence of the intention to reach consensus in Anna's words led Pandit to a situation where she did not appear to understand why changing the scale of the drawing was necessary. We cannot infer the extent to which Pandit thought the scale was an important issue for solving the task. Nonetheless, Anna was "forced" by Pandit's reluctance to agree with her about the scale, to further justify the necessity to change it ("Because it's going to be too small"). Pandit replied "It's okay". Anna's words ("Because it's going to be too small") became an

attempt to address Pandit's reluctance to accept the change of the scale. Anna was adding a validity claim (in Habermas' terms) to the conversation, in order to reach consensus with Pandit on the scale. However, at the end of this IE, it is important to note that Anna and Pandit talked about changing the scale, making the square from 1 cm to 2 cm each side, using the word "double" (although we can notice that there is a misconception about 1D-2D here, because a 2 cm square is not "doubling" a 1 cm square). However, this is a more productive situation in terms of opportunities for learning rather than at the beginning of this IE, where one of the participants just imposed her idea with no further explanation. Anna's exchange with Pandit opened the space for other concepts to emerge, such as "doubling."

Another important aspect emerging from this analysis of the data is the fact that inquiry is a notable strategy for participants to search for consensus. Consistently with previous studies (Wells, 2001), our data suggests that students highly rely on inquiry as a method to create a shared (agreed) response to the task. They use inquiry frequently either to resist against someone's imperative claims (conative talk) or, more frequently (as showed in Tables 6 and 7), to create an opportunity to build together a consensual partial or final answer to the task. When Anna, Pandit, John and Arman engage in such a type of situations, their effort to justify their claims using the dialogic process made visible either coherence or error within their answers. For instance, accepting "rectangle" as a final shape for Fred's apartment was based on the group consensus (but not based on a mathematical fact, since there are many different possibilities to represent 60 m^2). The same applies to the types of rooms drawn to represent Fred's apartment (as we can observe when Pandit and Anna agreed on having the laundry attached to the kitchen). Students may even use implicit assumptions to frame their partial or final answers to the task as in the example of the shape of Fred's apartment (why should it be a rectangle, rather than other geometrical shape, such as a circle, for instance?). These findings are consistent with previous studies in the field, claiming that disagreement and discussion can support conceptual change and long-term retention of learning (Howe, 2010).

We have argued that dialogic talk is associated with effective learning, in line with other scholars in the field (Clarke, 2015; Clarke et al., 2016; Kelly, 2007). Students expand their boundaries of learning by resolving conflicts or contradictions when they try to solve a task, when they verbalise their thinking, explain or justify a potential solution, when they seek for alternative methods to overcome a difficulty, or when they formulate an explanation to clarify a particular aspect of the task (or another student' claim). In this study case we have seen Anna, Pandit, John and Arman discussing size, shape, type of rooms, to solve the task. Looking for valid explanations to justify their claims (valid in Habermas' and Flecha's terms), they engaged in discussions where they needed to use either mathematical facts (such as 30 times 20 is 600 rather than 60, which is the prescribed size for Fred's apartment, according to the task as presented to the students), or a group agreement, as a source of authority. However, how can we claim that learning is effective (or productive)? We assume that learning is effective when participants in the group reach a consensus in an answer that satisfactorily fulfils the task's requirements (in mathematical terms). For example, a plan for Fred's apartment in which the length is 30 m and the width is 20 m is not a suitable answer, since the area of such apartment would be 600 m^2 (so far away from the 60 m^2 prescribe for Fred's apartment). Therefore, we decided to add an additional dimension to our analysis (correctness), to characterise the types of talk better. Tables 8 and 9 provide a summary of what happened in the group.

Half of the times, declarative talk was associated to correct answers, whereas the other half was connected to non-correct answers. Declarative talk was predominantly neutral (in terms of illocutionary force). It tends to appear after someone makes a claim (either looking for consensus or using coercion), suggesting that declarative talk characterises situations in which the participants "follow" someone, without adding any other intentionality (for this reason, the illocutionary force tends to be neutral).

Inquiry talk was the second most common type of talk used by the students along with their conversation (23.5%). As illustrated in the second IE (the scale of the apartment drawing), the use of inquiry talk use to be part of a process of "creating a suitable answer" in which inquiry is a step to end with a valid argument, hence argumentative talk appears at the end of the sequence of dialogue. Inquiry is almost always associated with consensual intentionality but not always ends with a correct answer. When a student uses inquiry talk, it is to pose a question, to problematise a previous claim, but not to provide any explanation, nor any argument supporting his/her point of view. This happens when the inquiry talk is followed by a claim which can be verified by the rest of the participants in the discussion. Then, argumentative talk replaces inquiry talk.

Conative talk seems to complicate the process of looking for a suitable answer (and the learning opportunities embedded in it). In the case reported here, every time a student uses conative talk, it is associated with a non-correct answer. If the person's statement is correct, then the answer to the task is correct, and that's the end of the discussion of the topic. However, if the statement is non-correct, it is very difficult for the rest of the participants to counter the participant holding the strongest power position in the group. In any case, the lack of opportunities to exchange validity claims (in the sense that everyone in the group can verify by him/herself the correctness of the statement) makes learning opportunities more difficult to happen.

In contrast, when students seek agreement (thus they exchange their explanations to the task, sharing arguments -T7-), 30.8% of the times reach correct answers (whereas 8.3% of the times, they end with a non-correct answer). If we assume that dialogic talk means adding an argument based on a valid claim (following Soler & Flecha, 2010 and Habermas, 1984), then this data suggest that we can identify a potential pattern between dialogic talk and correctness that has to be confirmed by further research.

However, the data also suggest that there were more non-dialogic than dialogic talk in the students' conversations. The students frequently engaged in non-dialogic interactions, using one of six types of non-dialogic talk (in the case reported here, 94.1% vs. 5.9%). In a situation of collaborative small group work to solve an open-ended task, our data suggest that the students made many declarative statements without any intention to impose their own opinion (49.6% of the turns, discussion was "neutral" in terms of illocutionary force). However, we can also find moments in the discussion in which a student (or some students) want(ed) to impose their thoughts to the rest of the group. When this happened, resistance was one of the possible responses. A pattern of interaction that we have noticed consistently in the analysed segment discussed here is the use of "inquiry talk" may have provided opportunities for learning.

Finally, it is also relevant to highlight that emotions emerge constantly within the discussion. The students did not participate in the

debate as passive agents. Instead, they put their feelings in everything they do during the discussion (13.3% of "expressive talk" in the case analysed here). This emotional feeling may have a relevant impact on the ways in which interaction occurs. That creates the necessity to consider emotions as part of the analysis of the interaction.

5. Conclusions

The value of this study lies in the identification of the types of interaction that we have been able to notice within a collaborative small group work setting, and the association between them and the correctness (or non-correctness) of the answers provided by the students to the task. In the case examined here, a group of students were working together with minimal interference from the teacher. Most of the time, they engaged in non-dialogical interaction (94.1% of the turns). They used mostly either declarative talk (37.5%) or inquiry talk (23.5%).

We also found some interesting hints associating the *type of talk* with *correctness*. This relationship may inform/inspire further research examining previous findings holding that dialogue helps students to shape their understanding by talking, increasing their chances to learn (Clarke, 2015; Clarke et al., 2016; Kelly, 2007; Resnick et al., 2018). According to our case study, we will probably need to consider the intentionality of the speakers to establish the conditions for argumentation (which other studies demonstrates that is a crucial aspect of learning) to happen. Thus, teachers aiming to empower their students and fostering them to work together to learn, may have in mind that learning happens within interactive settings, in which participants (students) may use talk in a range of different ways, and not all of them have the same potential to create effective learning opportunities.

6. Limitations and future research

A case study offers a means for investigating complex social phenomena such as *interaction*, considering multiple variables and dimensions of analysis, of potential importance to understanding the phenomena (Stake, 2005). However, although case studies are appropriated for rich and detailed analysis, they fail to generalise the findings because generalisation is not aimed at this approach. Accordingly, this article seeks to find aspects that may help researchers, teachers, and other educational stakeholders understand the role that interaction may play in learning in small-group peer work settings. In the analysis of the case study selected, we discussed several findings potentially interesting for expanding the current state of the field. We do not aim to generalise the patterns between types of talk, intentionality and correctness in this article. An extensive survey using representative sampling and appropriated statistical methods would be needed to examine if there is some correlation between the variables that we have examined here. Of course, other questions that have not been addressed here, may also influence how students interact with each other in this type of environment, such as the role played by the teacher (we know that teachers may play a central role in the learning process scaffolding students' work, as suggested by Pea, 2004, Romo & Covián, 2018, Aguilera-Jiménez & Prados, 2020, or Farsani et al., 2020, among others). Additional research is needed to address such aspects within a learning environment such as the one reported here, in the future.

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