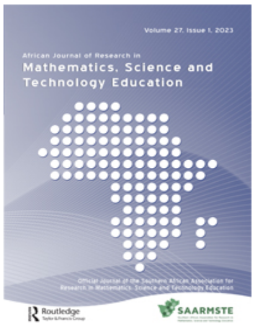

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Bloom's Taxonomy and Classroom Talk: Exploring the Relationship Between the Nature of Small Group Discussion Tasks and the Quality of Learners' Talk

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The purpose of this study was to investigate the relationship between the nature of small group discussion tasks and learners' talk during Physical Science lessons. The study was conducted during Physical Science lessons with three self-selected groups of Grade 11 learners from one school. A total of three lessons were followed. During the lessons, learners were given group tasks to complete, and their discussion was audio-recorded. The small group discussion tasks were coded using the revised Bloom's taxonomy. The audio-recordings were transcribed and coded using Mercer's three types of talk. The nature of tasks in the small group discussions was paired with the type of talk used as the group members were responding to the tasks and the frequency of these pairs was analysed. Analysis of the tasks vs. types of talk used indicated that learners predominately used cumulative talk to find solutions to understanding tasks. Exploratory talk was predominately used to find solutions to application tasks. The findings show that this relationship between the nature of small group discussion tasks and learners' type of talk is statistically significant at $p = 0.05$ level. No disputational talk occurrences were observed. It is noted that the type of talk used to address each type of task is related to the cognitive skills demanded by the task, group composition and the embracing of the spirit of ubuntu by the group members.

Keywords: *Science talk; cognitive levels; small groups discussion tasks*

Introduction

The South African school curriculum encourages an active and critical approach to learning (Department of Basic Education, 2011). The approach aims to ensure that learners remain actively engaged in the learning process by being involved in discussions with their teachers and peers. However, the reality of South African classrooms is that learners take a passive role in learning processes while teachers do most of the talking (Msimanga & Lelliott, 2014). A study by Sedova et al. (2019) shows that learners who are given opportunities to talk during lessons, taking an active role in learning, achieve better results than those who talk less. Resnick et al. (2018) suggest that such results are possible because talk enables learners to actively engage with content. They add that talk also enables learners to develop a repertoire of reasoning skills where they 'reason about content, rather than to memorize facts or follow rules to solve a string of similar problems' (Resnick et al., 2018, p. 331). This entails that talk promotes the use of a high level of cognition and is therefore valuable in the teaching and learning process. Hence, Khong et al. (2019) maintain that talk is important in learners' understanding and intellectual development.

In relation to the significant role that may be played by talk in the learning process, Msimanga and Lelliott (2014) argue for the use of small group discussions to improve learners' engagement in the teaching and learning processes in South African schools. Such use of talk will be beneficial to Science, Technology, Engineering and Mathematics (STEM) subjects as these place great value on high order thinking skills (HOTS), which include critical thinking, problem solving and creative thinking. Howe and Mercer (2007) add that small group discussions must be guided by tasks with open-ended questions that encourage collaborative engagement in order to achieve their intended learning objective. Such an understanding is limited as open-ended questions may demand a variety of cognitive skills which may influence the nature of small group discussions. There is paucity in research about the relationship between the level of cognitive demand of tasks and learners' talk during small group discussions. Such research will provide guidance on aspects to consider in order to maximise learners' engagement during small group discussions and to enable learning. As a result, this study sought to investigate the relationship between the nature of small group discussion tasks and learners' talk during Physical Science lessons.

Theoretical Perspectives and Literature Review Underpinning the Study

Small group discussions involve the use of talk to verbalise thoughts and internalise others' point of view. Littleton and Mercer (2013) add that talk does not only enable interactions to take place, it also enables people to think together. Discussions amongst learners can cause a shift in their level of understanding, thereby improving their actual development level within the zone of proximal development (ZPD), as learners' roles change from a more knowledgeable other to a less knowledgeable other and vice versa during the small group discussion. ZPD refers to the 'difference between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with a more capable peer' (Vygotsky, 1978: 86). The use of small group discussions follows Vygotsky's (1978) notion of learning being mediated through social interactions amongst people.

Mercer (1995) identified three types of talk during social interactions namely, disputational, cumulative and exploratory talk. According to Mercer (1995), disputational talk is the type of talk consisting of short exchanges comprising assertions and counter-assertions, thereby creating a competitive atmosphere amongst learners. In contrast, cumulative talk is a type of talk that lacks critical evaluation of ideas where learners tend to agree with anything said by their peers without interrogating it (Mercer, 1995). Both cumulative and disputational talk impede improvement of learners' understanding during small group discussions as both types of talk limit the active engagement that is necessary in enabling learning. Exploratory talk is a type of talk that involves critical evaluation of ideas and, therefore, is considered valuable and effective in promoting conceptual learning (Mercer, 1995).

Levels of Cognitive Demand

The levels of cognitive demand of various task types are well categorised by Bloom's taxonomy (Bloom et al., 1956). This taxonomy was revised by Anderson et al. (2001) to include the types of knowledge engaged with when dealing with the various levels of cognitive demand. Figure 1 shows the revised version of Bloom's taxonomy. The six levels of cognitive demand shown in Figure 1 range from remembering, understanding, applying, analysing and evaluating to creating new products. The level of cognitive demand increases as you move from remember towards create. Those tasks requiring factual and conceptual knowledge are considered to demand low order thinking skills (LOTS). Low order thinking skills refer to thinking processes that require routine information and 'mechanical application of previously acquired information such as listing information previously memorised and inserting numbers into previously learned formulas' (Lewis & Smith, 1993: 193).

Tasks that require metacognitive knowledge, whereby learners analyse, evaluate and create as shown in Figure 1, demand high order thinking skills (HOTS). High order thinking skills refer to thinking

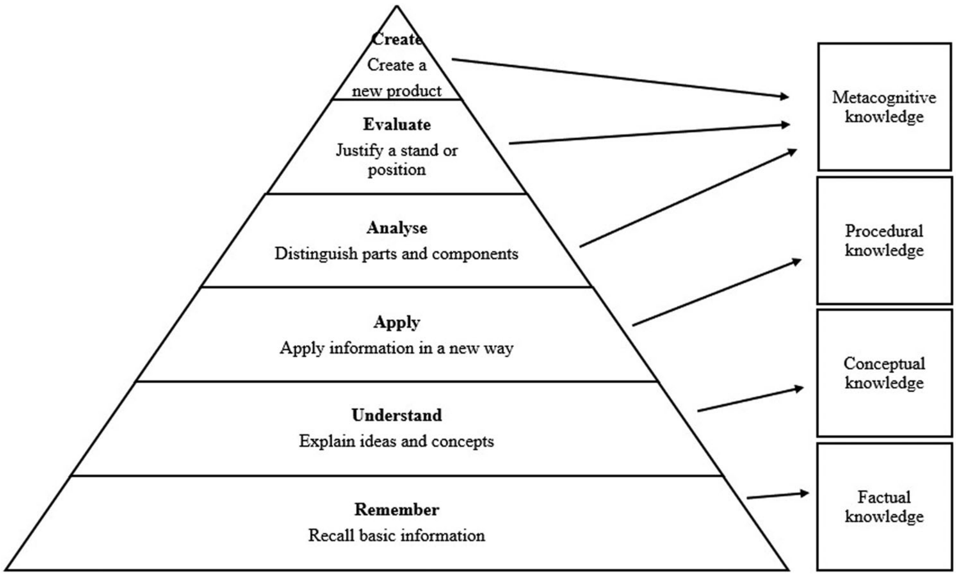


Figure 1. The revised Bloom's taxonomy (adapted from Jensen et al. 2014)

processes that require one to make use of new and stored information, by interrelating, rearranging and extending information to achieve an intended objective (Lewis & Smith, 1993). According to Crowe et al. (2008), tasks that require learners to apply information in new ways demand thinking processes that are between LOTS and HOTS, known as intermediate level. Such tasks involve the use of procedural knowledge as shown in Figure 1, which is concerned with the method used to complete a task although a great deal of conceptual understanding is required. However, this study considers application tasks to demand HOTS as learners are required to use their conceptual knowledge as they apply it in new ways and situations, therefore demanding some critical thinking, although this is at a lower level than those tasks promoting metacognitive knowledge. Therefore, tasks that require learners to apply, analyse, evaluate and create are considered to be HOTS, thus placed at the top of the triangle in Figure 1.

Talk and the Level of Cognitive Demand in Group Work Tasks

Kutnick and Blatchford (2014) identified three approaches in which group work can be organised. The first approach is called individuated work with talk and involves learners working individually on the same task while allowed to talk to their fellow learners about the task. The second approach is called peer interactive work and it involves learners working on the same task with a shared goal and required to talk with fellow group members about the task. Peer interactive work is the small group discussion approach this study will be focusing on. The last approach involves learners in a group working with the teacher on the same or a different task. In either structure, group work provides learners with an opportunity to learn to 'share and listen to ideas, clarify misconceptions when they arise and become more willing to provide extended explanations that facilitate deeper understanding and continued engagement in the subject-matter' (Chan, 2020: 4).

High-level tasks are essential for promoting effective and meaningful small group discussions, particularly in STEM subjects, as they can enhance learners' critical analysis and evaluation skills. Smart and Marshall (2013) conducted a study to understand factors affecting the interactions between teachers and learners. They found a positive relationship between the level of tasks used by the teacher and learners' cognitive level. They noted that when teachers used high-level tasks that required learners to analyse and evaluate, the observed cognitive level in learners was higher and was low when the teacher used low-level tasks. Similar observations were made by Jensen et al. (2014), where they found that using tasks that require a high level of cognitive demand throughout the teaching process enhanced learners' conceptual understanding. Such findings help us to understand the important role played by tasks learners engage in during the teaching and learning process. In group work, such a role can be played by the task given to learners to facilitate their engagement. However, the relationship between the cognitive demand of tasks for small group discussions and learners' talk in their group has not been explored. Such knowledge will be valuable in preparing small group tasks for the purpose of enhancing understanding and enabling learning.

Methodology

In order to explore the relationship between the cognitive demand of tasks for small group discussions and learners' talk in their groups, this qualitative case study was conducted in one of the public schools in Soweto, in 2018. The study focused on 32 Grade 11 learners and their Physical Science teacher, who voluntarily participated in the study. The selection of the study participants was both purposive and convenient. It was purposive in that the researchers sought a Grade 11 physical Science teacher who was willing to contribute to the study. It was convenient because the selected teacher then assisted in selecting learner participants of the study from among his classes. Using this approach, 24 out of 32 Grade 11 Physical Science learners were selected as they voluntarily consented to participate in this study. These learners did not receive any kind of coaching on how to carry out discussions. This study focuses on the discussions of only 13 out of 24 learners. The 13 learners were selected using the assistance of the teacher based on his observations of seeing these learners working in groups even when given individual activities in his lessons.

The learners formed three self-selected small groups. The groups were labelled groups A–C, with four, five and four members, respectively. Learners were given tasks to complete by their teacher. The teacher instructed learners to discuss the task with their group members. However, each learner was expected to have their own individual write-up. The teacher was not involved in the discussions unless called upon by the learners. As such, learners enjoyed the freedom of discussing with their group members in their own preferred language. Audio-recorders were used to collect data by capturing the talk between learners as they worked on tasks. The tasks were coded using the revised Bloom's taxonomy, as shown in Figure 1, where each task was classified as a remember, understand, apply, analyse, evaluate or create task. Data were collected during three consecutive lessons. The first two lessons focused on Ohm's law: the relationship between current, potential difference and resistance. The last lesson focused on solving conceptual problems using the mathematical expression of Ohm's law for series and parallel circuits.

The captured talk was transcribed and read several times to ensure that the data were captured accurately. The transcripts were then analysed using Mercer's (1995) types of talk to understand the nature of talk learners employed as they were working on each task. Each type of talk was identified using characteristics of disputational, cumulative and exploratory talk as discussed above. The two differently coded sets of data were brought together and re-coded as shown in Table 1.

Table 1. Bloom's taxonomy and talk codes

Bloom's taxonomy	Disputational talk	Cumulative talk	Exploratory talk
Remember	RDT	RCT	RET
Understand	UDT	UCT	UET
Apply	ApDT	ApCT	ApET
Analyse	AnDT	AnCT	AnET
Evaluate	EDT	ECT	EET
Create	CDT	CCT	CET

Table 1 shows the codes that were used to categorise each type of talk against the task type. For instance, if cumulative talk was used to answer an application task, that talk instance is coded as ApCT while a cumulative talk instance used to answer an evaluation question is coded as ECT. To ensure validity and reliability of these findings, two researchers categorised the raw data transcripts independently using the agreed talk codes (see Table 1). Cohen's kappa was used to check the level of agreement between the coders. On comparison, if the Cohen kappa was between 0.6 and 0.8, the coding had to be renegotiated. This was achieved through consensus building. The average Cohen's kappa for the whole data set was 0.9, which indicates that the coders had a nearly perfect agreement as they coded the data. After having coded the data as illustrated in the two figures, the frequency of each code shown in Table 1 was determined and represented as shown in Table 2. Thereafter, the trends showing the relationship between the cognitive demand of tasks for small group discussions and learners' talk in their group was explored.

Findings

This study found that cumulative and exploratory talk were predominantly used by the groups of learners as they were finding solutions to the tasks which demanded the use of different thinking skills. However, no occurrences of disputational talk were found during their interaction. Figure 2 shows the discussion between Group A learners as they were finding solutions to Task 2 during the first observed Physical Science lesson.

Figure 2 shows group A learners' talk when they were engaging with an understanding task. In this figure, Thato in line 1 is proposing a solution to the question. In lines 2–12, Neo is agreeing with what Thato is saying without asking any questions that will enable exploration of ideas. Accepting ideas without critically evaluating them is one of the characteristics of cumulative talk. Therefore, the discussion in Figure 2 represents cumulative talk. Figure 3 represents learners' talk as they were responding to an application task.

Figure 3 is taken from group B's discussion of the task shown at the top of the figure. In this Figure 3, Tumelo does not understand how to work out the given application task (line 1). Thabang in line 2, explains how Tumelo should work out the solution to the task. However, Thabo in lines 3–14 questions the approach suggested by Thabang, compelling him to review the approach he was suggesting. While Thabang is trying to figure out a way to address the task, Thabo in line 16 comes up with another way to solve the problem while at the end seeking confirmation from his peers. In this exchange, group members are asking questions and sharing relevant information that they think is necessary to address the task. Sharing of relevant information and asking of questions are characteristics of exploratory talk. Thus, this talk instance represents exploratory talk.

Table 2 summarises the findings from the analysis of the tasks given to learners as group work during three consecutive lessons in a Grade 11 Physical Sciences classroom.

Table 2. Frequencies of the relationship between the task demand and the nature of learner talk

Task demand	Nature of talk in learner groups			
	Disputational talk (group A–B–C)	Cumulative talk (group A–B–C)	Exploratory talk (group A–B–C)	Total
Remember	0 (0–0–0)	1 (0–1–0)	1 (0–1–0)	2
Understand	0 (0–0–0)	17 (6–7–4)	11 (6–3–2)	28
Apply	0 (0–0–0)	3 (2–0–1)	9 (3–4–2)	12
Analyse	0 (0–0–0)	0 (0–0–0)	0 (0–0–0)	0
Evaluate	0 (0–0–0)	0 (0–0–0)	1 (0–1–0)	1
Create	0 (0–0–0)	0 (0–0–0)	1 (0–1–0)	1
Total per group	0–0–0	8–8–5	9–10–4	17–18–9
Total	0	21	23	44

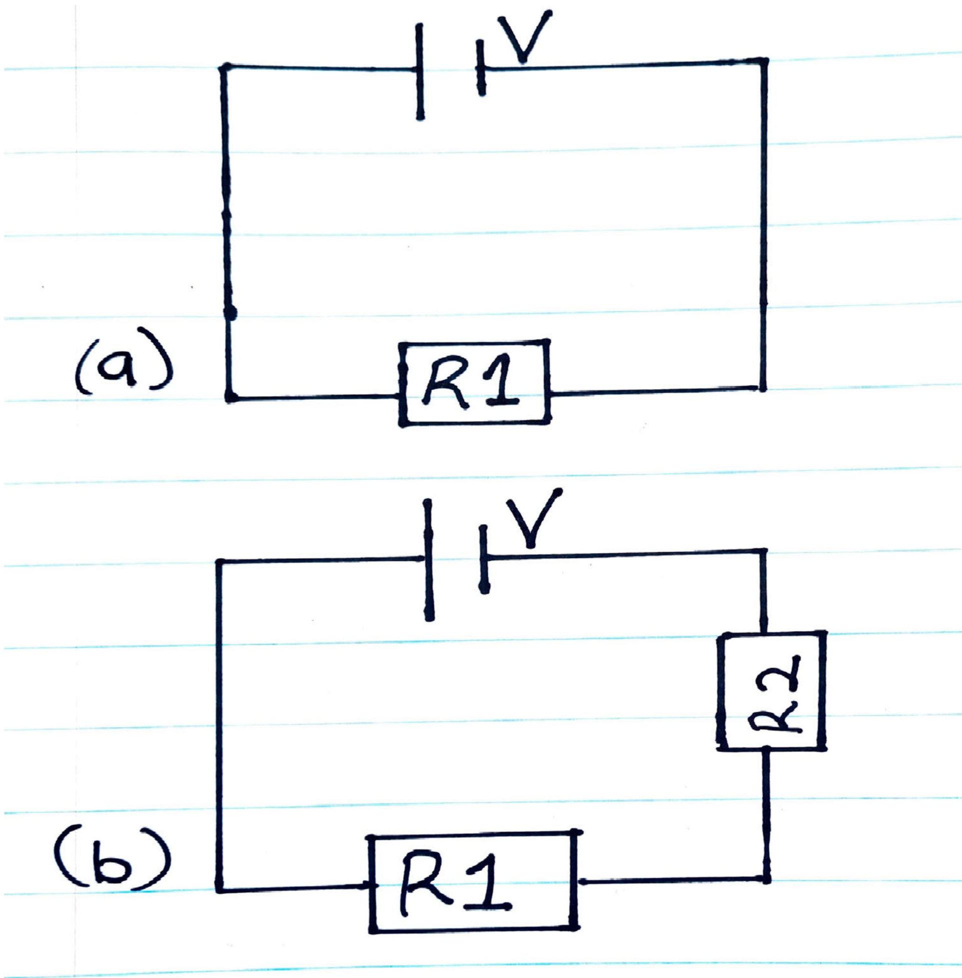
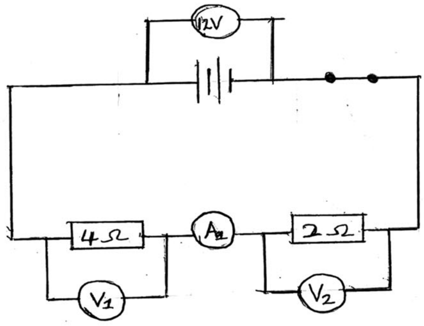


Figure 2. Lesson 1 task 2: group A discussion

Table 2 shows that a vast majority of the tasks given to the learners demanded understanding and application. Further, Table 2 shows that understanding tasks were primarily addressed through cumulative talk (17 out of 28 instances) while application tasks were most frequently addressed through exploratory talk (nine out of 12 instances). Table 2 also shows that exploratory talk was the only type of talk used in addressing the few evaluate and create tasks. Moreover, Table 2 shows that no talk occurrences were observed in analysing tasks while one occurrence of cumulative and exploratory talk, respectively, was observed in remembering tasks. Overall, Table 2 shows that there were more occurrences in the understanding tasks followed by application, remembering, evaluate and create, respectively. Additionally, there were no occurrences of disputational talk in any of the tasks discussed. However, there were 21 cumulative talk and 23 exploratory talk occurrences.

To further tease out whether there was any association between the type of task given by the teacher and the type of talk learners engaged in to complete the task, a significance chi-square test was conducted on the coded data in Table 2. The null hypothesis explored was that there is no observed relationship between the task provided and the type of talk learners engaged in to complete the task. Since none of the learner groups engaged in disputational talk, the analysis was limited

Consider the circuit diagram below.



Calculate the total current in the circuit.

Learners' discussion:

1 Thabo: guys I don't understand. What are we doing?

2 Thabang: we are supposed to find the total current. You must find I. Its V is equal to I times R. So, you must find the I. But first you have to find the total resistance to give us the total current. Or Thabiso explain this well to Thabo, it looks like I am failing to explain it.

3 Thabo: wait, you calculated total resistance. How will this total resistance help us get total current?

4 Thabang: R total is equal to V total divided by I total.

5 Thabo: Okay. Wait, how do you get V_{total}?

6 Thabang: There it is

7 Thabo: Thabang check, there are two V's here, its V_1 and V_2

8 Thabang: okay, this is what you do. You calculate the voltage on each resistor and add them. Then you say R total is equal to V total divided by I total

9 Thabo: yes, you see

10 Tumelo: what are you saying?

11 Thabang: we have V_1 and V_2, you calculate them and then add them together. This will give you total voltage then you say R total is equal to V total divided by I total. We have V total and R total.

12 Thabo: we are also supposed to calculate V total? Wait, how do you calculate V total without I? Without current

13 Tumelo: yes Thabang, how do you calculate it without current?

14 Thabang: let me check

15 Tumelo: wait, they gave us…isn't V total 12 volts?

16 Thabo: guys, it looks like V_1 and V_2 are not needed

17 Tumelo: Why?

18 Thabang: we don't have current

19 Thabo: no, I don't think so. For us to calculate I total, we don't have to calculate V_1 and V_2 because we have calculated the total resistance. Total resistance is equal to total voltage over I

20 Tumelo: Thabang, we don't need V_1 and V_2. Why don't we use 12 volts?

21 Thabang: as total voltage?

22 Tumelo: it is the EMF

23 Thabo: it is total volts from the cell. The cell gives us 12V, right?

24 Tumelo: yes

25 Thabo: so, what will be circulating will be this 12V. We just need to calculate the total resistance and then we use it together with the given V. Or how do you look at it?

Figure 3. Lesson 3 task 1: group B discussion

to cumulative and exploratory talk. The task demand categories were also simplified into two groups: remembering and understanding (LOTS), and application, analysis and creativity (HOTS). This provided a two by two matrix (see Table 3), thus yielding one degree of freedom (d.f. = 1).

The computed value of chi-square based on the coded frequencies in Table 3 ($n = 44$) was found to be 5.69, which is considerably higher than the standardised chi-square value obtained from statistical tables at d.f. = 1 and significance level $p = 0.05$ ($\chi^2 = 3.84$). This points to the rejection of the null hypothesis, and implies that there was a significant relationship between the nature of the task provided and the type of talk that learners engaged in to complete the task. However, we need to be careful to read too much into this statistic as the sample under study was rather small. A larger sample would be required to provide a clearer picture of the nature of the association. Even with this proviso, these findings do provide a tentative possibility that the type of talk used by learners during small group discussions is related to the nature (cognitive level) of the tasks that they are presented with.

Table 2 also shows that group B had the most talk occurrences, 18, followed by group A with 17 occurrences, and group C with 9 occurrences, respectively. Table 2 indicates that group A does not differentiate in their choice of talk according to the task demands as they choose cumulative and exploratory talk seemingly randomly (or equally frequently) for each task demand. Instead, group B chose largely cumulative talk for tasks demanding understanding and exploratory talk for application tasks. The pattern of talk in group C may resemble the pattern from group B but the number of observed incidents for this group is relatively low. Thus, the data show a relationship between task demands and the type of talk used in small group discussions. In addition, the data shows that group composition may also have an effect on the type of talk used by the learners.

Discussion

This study found that the group of learners predominately used exploratory talk to address application tasks. The presence of exploratory talk in their small group discussions is related to the cognitive skills demanded by the task. The productive and lengthy exchanges that learners had while thinking together and discussing suitable procedures to follow in order to find solutions to the application tasks, their conceptual understanding and reasoning skills required to advance their procedural and conceptual knowledge were enhanced in accordance with the findings by Smart and Marshall (2013) and Jensen et al. (2014). Improvement in the conceptual and procedural knowledge of these learners will advance their overall performance in the topic, consequently improving their performance in the subject as per Sedova et al. (2019).

The findings suggest that learners were using exploratory talk in response to the high cognitive nature of application tasks, a relationship that Mercer et al. (2004) had also predicted. The learners may have found the application tasks to be very challenging as they used exploratory talk mostly to address them. The challenging nature of these tasks is related to their position in Figure 1, that they demand HOTS unlike understanding tasks which demand LOTS. Application tasks require learners to make use of their acquired conceptual knowledge and apply information in new ways in order

Table 3. (2 × 2 matrix) for chi-squared testing

Task demand	Nature of talk		
	Cumulative talk	Exploratory talk	total
Remember and understand (LOTS)	O = 18 E = 21 × 30/44 = 14.318	O = 12 E = 21 × 30/44 = 15.682	30
Apply, analyse, evaluate and create (HOTS)	O = 3 E = 21 × 14/44 = 6.682	O = 11 E = 21 × 14/44 = 7.318	14
Total	21	23	44

to achieve an intended objective. Thus, suggesting that tasks demanding HOTS, such as application tasks, elicit the use of exploratory talk.

While exploratory talk may have been predominately used in application tasks, cumulative talk was primarily used in understanding tasks. Understanding tasks require and enhance conceptual knowledge as indicated in Figure 1. However, the predominant use of cumulative talk in such tasks meant that learners simply agreed with their fellow group members on proposed ideas without critical evaluation of those ideas. While Mercer et al. (2004) attribute learners' prevalent use of cumulative talk to undeveloped reasoning skills, Scholtz et al. (2008) relate it to the strength of their knowledge base for the content being engaged with. Mercer et al.'s (2004) attribution of learners' prevalent use of cumulative talk to undeveloped reasoning skills cannot be true in this study because the groups of learners (1) predominately engaged in exploratory talk as compared to cumulative talk and (2) exploratory talk was predominately used in application tasks which are at a higher cognitive level than understanding tasks. Similar to Mercer et al. (2004), Scholtz et al.'s (2008) explanation does not apply in this study although learners did not actively engage in critical evaluation of proposed ideas in order to address the understanding tasks. In this study, the prevalent use of cumulative talk to address understanding tasks is related to the cognitive skills demanded by the task. Understanding tasks require LOTS as they are about ideas and concepts explanation. This is information that learners can remember from the teaching that may have taken place and from reading, unlike tasks at higher cognitive levels which demand the application of information in new ways, analysis, evaluation and the creation of new products, ultimately developing learners' procedural and metacognitive knowledge. Therefore the nature of the understanding tasks requires more consensus building than critical exploration. Learners were prone to relate the tasks to memory and build consensus (agree and offer more supporting ideas) than to evaluate implications of ideas offered.

Since the learners involved in this study were untutored in group work, the absence of disputational talk occurrences in their discussion may be related to their cultural background, which makes them more inclined to the inclusive argumentation concept. Inclusive argumentation is a concept coined by Scholtz et al. (2008) to describe 'the ability to provide evidence and justifications for claims or decisions taking cognisance of the views of others' (p. 32). Inclusive argumentation acknowledges the role *ubuntu* plays in discussions. *Ubuntu* diminishes the need for confrontational interactions and promotes the togetherness atmosphere. In such an atmosphere, learners would support contributions that are non-opposing and adopt neutral stances if the need to disagree emerges (Scholtz et al., 2008). In this study, learners were working in harmony, without confrontational occurrences which are disputational in nature. To ensure that the groups' atmosphere remains harmonious, learners engaged in cumulative and exploratory talk only throughout their discussions as seen in Table 2.

This study acknowledges that although application tasks and understanding tasks were addressed using predominately exploratory talk and cumulative talk, respectively, there are other factors at play that must be considered in understanding the choices of talk used by learners to address the different types of tasks in this study. The first factor is group characteristics. This study found that group composition may have an effect on the type of talk used by the learners as different groups used talk differently. Group A was seemingly not differentiating in their choice of talk vs. task type as researchers observed equal occurrences of cumulative talk and exploratory talk. Group B and C seemingly used cumulative talk and exploratory talk to address understanding and application tasks, respectively. This is of particular importance since learners grouped themselves using their own criteria unknown to the researchers. Therefore, the characteristics of the groups seem to be a determinant of the choice of talk used to address each type of task. More research is required to understand this phenomenon.

The second factor that must be considered in understanding the choices of talk used by learners in each type of task addressed is the language used by the learners to discuss the given tasks. Learners in this study had the freedom to interact with their peers using a language they were comfortable with. Therefore, the group interactions were not impeded by barriers in the language of teaching and learning, as Scholtz et al. (2008) proclaim that a limited capability in the language used to articulate ideas hinders learners' ability to engage in talk effectively. Taking Scholtz et al.'s (2008) observation, this study acknowledges that the findings might change if learners had to strictly use the language of teaching and teaching of the school, which is English, as the learners were not English home language speakers.

The last factor that must be considered in understanding the choices of talk used by learners in each type of task addressed is the involvement of teachers in learners' small group discussions. In this study, the teacher did not interfere with learners' interactions as learners were expected to report their answers to the teacher during the whole class discussion following the group discussions. Thus, learners were free to interact with their peers in the absence of their teacher's involvement the way they see fit. Active involvement of the teacher during the small group discussions may alter the type of talk used to address each task.

Conclusion

This study gathers that there is an association between the cognitive nature of small group discussion tasks and the type of talk used to address the tasks. This study found that understanding tasks, demanding LOTS, prompted the use of cumulative talk while application tasks, demanding HOTS, tended to elicit the use of exploratory talk during small group discussions. The absence of disputational talk occurrences in this study is related to learners embracing the spirit of *ubuntu* which raises the need for learners to maintain a harmonious working atmosphere that promotes non-confrontational interactions amongst learners in their respective groups. This study also found that group characteristics may have been a determinant of the choice of talk used by the learners for each task type. However, this study does not have the required data to provide a detailed explanation on this finding. Further research is required to understand the impact of group characteristics on the choice of talk for different demands of small group discussion tasks.

Finally, though the chi-square test tentatively identifies a relationship between the nature of task and the type of talk learners engaged in, there is insufficient evidence to enable an understanding of this relationship owing to the limited sample size. There is a need for further explorations with larger samples to establish the exact nature of such a relationship.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

References

Anderson, L. W., Krathwohl, D. R., Airiasian, W., Cruikshank, K. A., Mayer, R. E., & Pintrich, P. R. (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational outcomes*. Longman.

Bloom, B. S., Krathwohl, D. R., & Masia, B. B. (1956). *Taxonomy of educational objectives: The classification of educational goals*. D. McKay.

Chan, M. (2020). A multilevel SEM study of classroom talk on cooperative learning and academic achievement: Does cooperative scaffolding matter? *International Journal of Educational Research*, *101*, 101564. https://doi.org/10.1016/j.ijer.2020.101564

Crowe, A., Dirks, C., & Wendcroth, M. P. (2008). Biology in Bloom: Implementing Bloom's taxonomy to enhance student learning in biology. *CBE—Life Sciences Education*, *7*, 368–381.

Department of Basic Education (2011). *Curriculum and Assessment Policy Statement (CAPS)*. Government Printer.

Howe, C., & Mercer, N. (2007). *Children's social development, peer interaction and classroom learning (primary review research survey 2/1b)*. University of Cambridge, Faculty of Education.

Jensen, J. L., McDaniel, M. A., Woodard, S. M., & Kummer, T. A. (2014). Teaching to the test … or testing to teach: Exams requiring higher order thinking skills encourage greater conceptual understanding. *Educational Psychology Review*, *26*(2), 307–329. https://doi.org/10.1007/s10648-013-9248-9

Khong, T. D. H., Saito, E., & Gillies, R. M. (2019). Key issues in productive classroom talk and interventions. *Educational Review*, *71*(3), 334–349. https://doi.org/10.1080/00131911.2017.1410105

Kutnick, P., & Blatchford, P. (2014). *Effective group work in primary school classrooms*. Springer. https://doi.org/10.1007/978-94-007-6991-5

Lewis, A., & Smith, D. (1993). Defining higher order thinking . *Theory into Practice*, *32*(3), 131–137.

Littleton, K., & Mercer, N. (Eds.) (2013). *Interthinking: Putting talk to work* (1st ed.). Routledge. https://www.taylorfrancis.com/chapters/mono/10.43249780203809433-8/understanding-interthinking-karen-littleton-neil-mercer?context=ubx&refId=53f99d8c-1133-4859-a847-b5a45ff5c106

Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Multilingual Matters.

Mercer, N., Dawes, L., Wegerif, R. & Sams, C. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, *30*(3), 359–377.

Msimanga, A., & Lelliott, A. (2014). Talking science in multilingual contexts in South Africa: Possibilities and challenges for engagement in learners home languages in high school classrooms. *International Journal of Science Education*, *36*(7), 1159–1183. https://doi.org/10.1080/09500693.2013.851427

Resnick, L. B., Asterhan, C. S. C., Clarke, S. N., & Schantz, F. (2018). Next generation research in dialogic learning. In G. E. Hall, L. F. Quinn, & D. M. Gollnick (Eds.), *The Wiley handbook of teaching and learning* (pp. 323–338). John Wiley. https://doi.org/10.1002/9781118955901.ch13

Scholtz, Z., Braund, M., Hodges, M., Koopman, R., & Lubben, F. (2008). South African teachers' ability to argue: The emergence of inclusive argumentation. *International Journal of Educational Development*, *28*(1), 21–34. https://doi.org/10.1016/j.ijedudev.2006.12.005

Sedova, K., Sedlacek, M., Svaricek, R., Majcik, M., Navratilova, J., Drexlerova, A., … Salamounova, Z. (2019). Do those who talk more learn more? The relationship between student classroom talk and student achievement. *Learning and Instruction*, *63*, 101217.

Smart, J. B., & Marshall, J. C. (2013). Interactions between classroom discourse, teacher questioning, and student cognitive engagement in middle school science. *Journal of Science Teacher Education*, *24*(2), 249–267. https://doi.org/10.1007/s10972-012-9297-9

Vygotsky, L. (1978). Interaction between learning and development . In L. Vygotsky, *Mind in society: The development of higher psychological processes* (pp. 79–91). Harvard University Press.