

THE NATURE OF CLASSROOM DISCOURSE IN PRE-SERVICE LIFE SCIENCES TEACHERS' LESSONS IN JOHANNESBURG

Lydia Mavuru

Department of Science and Technology Education, University of Johannesburg (South Africa)

Abstract

This is a qualitative case study which sought to determine the nature of classroom discourse in three pre-service Life Sciences teachers' lessons. There has been fervent discussion on the need for dialogic teaching with researchers indicating its potential in learner cognitive development and yet the approach exerts increasing demands on teacher input. Unlike a normal conversation, dialogic teaching involves the teacher initiating dialogue and making follow up on learners' responses. As such, there is a coherent process of enquiry occurring in the science classroom, rather than disjointed communication between the teacher and the learners. Previous research has revealed that science teachers encounter daunting challenges in their bid to ensure their teaching becomes more dialogical. It is against this background that three pre-service Life Sciences teachers were observed each teaching one lesson and then interviewed once after the analysis of the videos of the lessons. The interviews solicited teachers' intentions when they asked questions, and engaged learners in class interactive activities. Analysis of the videos and interviews showed that classroom discourse in these three lessons alternated between being dialogic and authoritative teaching styles. The findings showed that in as much as the pre-service teachers plan for dialogic teaching, sometimes they abort their plan due to various issues which include failure to initiate a sustained dialogue, inability to probe learners' ideas, lack of knowledge of some of the ideas learners bring in the discussion and also lack of effective classroom management skills. These findings inform teacher professional development programmes and teacher educators on the pertinent knowledge and skills that science teachers require for effective science teaching and learning.

Keywords: *Classroom discourse, pre-service teachers, life sciences.*

1. Introduction

There has been increased discussion on the need for dialogic teaching with researchers indicating its potential in learner cognitive development and yet increasing demands on teacher input. Unlike a normal conversation, dialogic teaching involves the teacher initiating dialogue and making a follow up on learners' responses. As such, there is a coherent process of enquiry occurring in the science classroom, rather than disconnected communication between teacher and learners. In fact in dialogic teaching, there is support and reciprocity in terms of interaction and the teacher's role also includes initiating learner sharing of divergent ideas in terms of science and their everyday views. Sociocultural theorists explain how individuals acquire knowledge when they interact with others, and also how interactions amongst individuals create collective understanding. Cognisant of this, social constructivists acknowledge that knowledge construction involves socialisation of individuals into the practices of the communities in which they are embedded, hence the importance of interactions in science teaching and learning. Previous research has revealed that it is quite challenging for science teachers to ensure their teaching becomes more dialogical (Scott, Mortimer & Aguiar, 2006).

2. Literature review

The nature of a social environment, in this case science classroom is crucial. Social interaction between individuals has been emphasised in ensuring meaningful teaching and learning in science classrooms (Lemke, 1990). The interaction referred to is the teacher-learner and learner-learner interactions. Walsh (2006) insists that classroom discourse, language use and interaction are the basis of good teaching and learning. Discourse refers to the use of language in context (Kaya, 2016) and in this case the context is the Life Sciences classrooms.

Unlike the normal conversation, dialogic teaching involves the teacher initiating dialogue and makes a follow up on learners' responses (Alexander, 2006). As such, there is a coherent enquiring process occurring in the science classroom, rather than disconnected communication between teacher and learners and learners and learners (Lehesvuori, Viiri & Rasku-Puttonen, 2011). In fact, in dialogic teaching, there is support, reciprocity in terms of interaction and the teacher's role also includes initiating learner sharing of divergent ideas in terms of science and their everyday views (Lemke, 1990; Mortimer & Scott, 2003). The practice of dialogic teaching has been acknowledged as a productive teaching practice as it leads to positive learning outcomes (Littleton & Howe, 2009). Unfortunately, in most classrooms group work has been found to be unproductive due to failure by learners to communicate and work collaboratively in an effective manner (Littleton & Howe, 2010). Teachers tend to make assumptions that learners are capable of engaging in meaningful conversation with each other in class. In line with social constructivist epistemology, Wells (2007) noted that effective learning takes place when learners are engaged in restructuring their knowledge and understanding cognitively.

It is quite challenging for science teachers to ensure their teaching becomes more dialogical (Scott, Mortimer & Aguiar, 2006). Knowledge construction involves socialization of individuals into the practices of the communities in which they are embedded, hence the importance of the role of learners' socio-cultural background in science teaching and learning. Sociocultural theory explains how individuals acquire knowledge when they interact with others, and also how interactions amongst individuals create collective understanding (Mercer & Howe, 2012). It is against this background that the study aimed to determine the nature of discourse in the Grade 10 and 11 Life Sciences classrooms. The study sought to answer the research question: What is the nature of classroom discourse in three pre-service Life Sciences classrooms?

The study uses the communicative approaches as the conceptual framework as espoused by Mortimer and Scott (2003). These approaches describe the classroom interaction patterns between the teachers and learners in the classrooms. Accordingly the first dimension is made up of dialogical and authoritative conversations. The second dimension comprises interactive and non-interactive conversations. As such, Mortimer and Scott put forward the interactive/authoritative (IA) approach where the lesson presentation is mostly question and answer session, Interactive/Dialogical (ID) approach where discussion takes the centre stage during the teaching and learning process, Non-interactive/Authoritative (NA) approach where the lesson takes the form of a seminar or conference and lastly Non-interactive/Dialogical (ND) communicative approach where the teacher summarises and explains concepts that were mentioned or discussed before.

3. Methodology

The study employed an explanatory mixed method research design (Creswell, 2014), which is a combination of both quantitative and qualitative research designs. The researcher collected quantitative data, analyzed it and then collected qualitative data to explain or inform quantitative data (Creswell, 2003). The method enabled the examination of the nature of classroom discourse and how teachers created such discourses in their classrooms.

3.1. Context of the study

The study involved five pre-service Life Sciences teachers in their final year (fourth year) who were enrolled in the module Methodology and Practicum FET Life Sciences. These participants had shown interest in taking part in the study. In the previous three years, they studied the theories of teaching and learning and content on all the topics in the Curriculum and Assessment Policy (CAPS) Life Sciences document, which encapsulates the requirements of the what, how and why the subject is supposed to be taught. During the three years and the first semester of fourth year, the participants had been involved in teaching practice, where they have been deployed in different schools to firstly observe many lessons of their mentors teaching Life Sciences learners of grades 10-12 and also teaching the subject. Therefore, the participants were familiar with Life Sciences teaching in different South classroom contexts.

For this particular session during second semester of fourth year, the participants were placed in schools for seven weeks and were expected to plan, prepare and teach Life Sciences to grade 10 and/or grade 11 learners. In this instance they had the autonomy to design their own lessons and implement teaching strategies they had learned during lectures without any restrictions from the mentors. The results of only three participants are reported. These participants taught in diverse school and classroom contexts which were assumed to have an influence on the classroom interaction patterns because of the diverse learner backgrounds in terms of race, language and socio-economic background. Table 1 shows the participants' profiles.

Table 1. Teacher profiles and research context.

Teachers' pseudonyms	Mantwa	Zola	Sarath
Gender	Female	Male	Female
Race	Black	Black	Indian
School type	Township	Suburban	Private
Grade taught	10	11	10
Number of learners	45	42	38

3.2. Data collection

Each teacher was observed teaching three lessons to determine the nature of classroom discourse in three pre-service Life Sciences classrooms and then interviewed three times after the analysis of the video of each of the lessons. The interviews were meant to solicit the pre-service teachers' intentions when they engaged learners in the different lesson activities and also for them to elaborate on observed incidences. Both the lessons and interviews were video and audio recorded with permission from the participants. In this paper only the findings of three lessons and three interviews are reported.

3.3. Data analysis

Data from the videos of the lessons were analysed using Mortimer and Scott's (2003) four communicative approaches. The four communicative approaches are Interactive/Authoritative (IA), Non-interactive/Authoritative (NA), Interactive/Dialogic (ID) and Non-interactive/Dialogic (ND). Every lesson was partitioned into five minute intervals and the researcher coded the interaction as IA, NA, ID and ND. At the end each communicative approach was quantified for each teacher's lesson to determine the overall nature of the lesson in terms of interactions portrayed. A comparison was then made using descriptive statistics.

Data from interviews was transcribed verbatim and then subjected to content analysis to clarify and seek elaboration on episodes observed in the lessons particularly on how they managed to create dialogical interaction and the challenges they faced. Content analysis is a flexible method for analysing text data (Cavanagh, 1997) and in this case the text came from pre-service teachers' reflections. Qualitative content analysis involves interpretation of the content of text data by systematically coding and identifying themes or patterns (Hsiu-Fang Hsieh & Shannon, 2005). The codes were categorised deductively using the key aspects in the questions given by the researcher. To promote more dependability on both quantitative and qualitative data, coding was done as soon as data were collected and then recoded after some time and then results compared (Krefting, 1991). An example of how lessons were analysed to determine the nature of classroom communicative approaches is shown in Figure 1.

Table 1. An example of the analysis of nature of communicative patterns in Mantwa's observed lesson.

5 minute intervals	Communicative approaches			
	IA	NA	ID	ND
1st	1	1	1	
2nd		1		1
3rd	1	1		1
4 th		2		
5 th	1			
6 th	1	2		
7 th		3		1
8 th	2			
Total 40 minutes	6	10	1	3

4. Findings

Analysis of the videos of the lessons portrayed the communicative approaches mostly used during the three pre-service teachers' lessons. An analysis of data from interview transcripts showed the reasons teachers lessons were more oriented to a particular communicative approach. Table 2 shows the overall percentages for the occurrence of each communicative approach in the three lessons.

Table 2. Summary of the nature of classroom approaches in the three teachers' lessons.

Communicative approach	Percentage attained		
	Mantwa	Zola	Sarath
Interactive/Dialogic (ID)	5	25	10
Non-interactive Dialogic (ND)	15	35	20
Interactive/Authoritative (IA)	30	20	50
Non-interactive/Authoritative (NA)	50	20	20
Total	100	100	100

From the summary table, it shows that Mantwa, who taught in a township Life Sciences class had the lowest percentage in interactive communicative approach (5%) and non-interactive dialogic approach (15%) compared to the other two teachers Zola and Sarath, who are in suburban and private schools respectively. The most communicative approach in Mantwa's lesson was non-interactive authoritative (50%). During interviews, Mantwa explained how she resorted to mostly presenting concepts without asking for learner input because township learners were not proficient in English language, which is the medium of instruction. English is their second language as it is different from learners' home languages. Mantwa said, "It is frustrating to keep on rephrasing questions when teaching because learners are not proficient in English". As such, the teacher presents the content in 'ready form' for learners to assimilate.

Both Zola (from a suburban school) and Sarath (from a private school) have the same percentage for non-interactive authoritative communicative approach though for different reasons. Zola pointed out that the learners were very vocal so much that if he asks for their opinions, it would create classroom management problems. Indeed, during lesson observations, the researcher noted how the pre-service teacher struggled to maintain discipline in his class. These learners were fluent in English but once given an opportunity to discuss issues, they could go overboard as evidenced by the highest percentage in both interactive (25%) and non-interactive (35%) dialogic communicative approaches.

On the other hand, Sarath who taught in a private school with goal driven learners had low percentages for both interactive (10%) and non-interactive (20%) dialogic communicative approaches. Unlike in the other two teachers' lessons, the teaching was driven by learners. For instance, the learners showed disinterest when the teacher asked them questions or provided an opportunity to discuss amongst themselves. As a result, the teacher resorted to authoritative communicative approach in a bid to cover as much content as possible, which the learners enjoyed. From the lesson observations, the researcher noticed the teacher dodging learners' questions. When asked in an interview, Sarath confirmed when she said, "These learners are very clever, some of the issues or questions they bring for discussion are quite challenging". By attaining a 50% in the interactive authoritative communicative approach, Sarath created a classroom environment where she limited learner autonomy and took control.

From the three pre-service teachers' lessons, it shows that the communicative approaches were determined by the teachers' prior knowledge of the nature of their learners. For instance, Mantwa's knowledge that her township learners had difficulty in expressing themselves in English, which is a second language, necessitated her to provide more content and notes to the learners. As such, there was more of non-interactive authoritative communicative approach and less dialogical. On the other hand, Zola's knowledge that his learners were outspoken and were proficient with the medium of instruction determined how he taught the lesson. Because Zola struggled with maintaining discipline during the teaching and learning process, he decided to limit the level of dialogical conversations in the class. In as much as his lesson had the highest percentage of interactive dialogical (25%) and non-interactive dialogical (35%) communicative approaches, more could have been achieved. In the other lesson Sarath's knowledge that her learners and parents to a certain extent had high expectations of learners' scores in assessment tasks, she focused more on content coverage. When asked in the interviews, Sarath said,

My first encounter with these learners was not pleasant, I felt they resisted my teaching. It was only later on when I realised that they felt I wasted time by asking them questions, whose answers they could get on their own when they study the content.

When probed further, Sarath indicated that there were several learners who tended to bring in challenging issues for her to explain. On that note she said, "I appreciate it if those few just listen and not contribute". What the pre-service teacher said confirmed the researcher's observation that in as much as the learners in that class were interested in content coverage, there were instances where the teacher deliberately manipulated them so that they could not ask questions or make contributions in class. It can be interpreted that the pre-service teacher had limitations in the subject matter knowledge and by involving learners, she would be exposed.

During lesson observations, it was noted that all the three pre-service teachers had intentions of involving learners in dialogic interactions as shown from the way they introduced the lessons and also the nature of the activities planned for the lessons. It was however unfortunate that such intentions were mostly aborted during the course of the lesson. Different reasons have been observed and mentioned by the participants themselves during interviews.

5. Discussion

The research findings showed how lack of proficiency in the language of teaching and learning impacted on the interactions in a township Life Sciences classroom. By shunning away from using learners' home languages, the teacher did not accord learners the full opportunity to access scientific concepts. Previous researchers argued for the use of learners' home languages as an effective strategy that makes science concepts more accessible to learners and also as a strategy that shows some degree of transformation in previously colonized African countries (Alidou et al., 2006). The findings also showed that pre-service teachers' lack of appropriate content and pedagogical knowledge impacted on their abilities to engage learners in interactive dialogical communicative approaches during the teaching and learning process, a challenge also identified by Scott et al. (2006).

6. Conclusion and implications

It can be concluded from the research findings that the pre-service teachers were aware of the importance of learner involvement in the teaching and learning of science. This is evidenced by their initial intentions during the introduction of the lessons where dialogic interaction is more prevalent compared to any other stage of the lessons. The pre-service teachers failed to sustain learner interactions mostly intentionally due to their shortcomings in terms of subject matter and pedagogical knowledge. The lesson taught in a township school was less dialogic compared to the lesson in a suburban school due to the medium of instruction, which learners are not fluent in. The findings inform teacher professional development programmes of the shortcomings and challenges that pre-service teachers need to be developed in even in their last year of study for effective teaching.

References

- Alexander, R.J. (2006) *Towards Dialogic Teaching* (3rd ed.) New York: Dialogos.
- Alidou, H., Boly, A., Brock-Utne, B., Diallo, Y. S., Heugh, K., & Wolff, H. E. (2006). Optimising learning and education in Africa: *The language factor*. Paris: ADEA.
- Cavanagh, S. (1997). Content analysis: concepts, methods and applications. *Nurse Researcher*, 4(3), 5-16.
- Creswell, J. (2014). *Research design. Qualitative, quantitative, mixed methods approach*. 4th ed. Thousand Oaks, California: Sage Publications.
- Cresswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* 2nd ed. Thousand Oaks, California: Sage Publications
- Hsiu-Fang Hsieh, H-F. & Shannon, S.E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288. doi: 10.1177/1049732305276687
- Kaya, G., Şardağ, M., Çakmakçı, G., Doğan, N., İrez, S. & Yalaki, Y. (2016). Discourse patterns and communicative approaches for teaching nature of science. *Education and Science*, 41(185), 83-99.
- Krefting, L. (1991). Rigor in Qualitative Research: The assessment of trustworthiness. *American Journal of Occupational Therapy*, 45(3), 214-222.
- Lehesvuori, S., Viiri, J. & Rasku-Puttonen, H. (2011). Introducing dialogic teaching to science student teachers. *Journal of Science Teacher Education*, 22, 705-727. doi 10.1007/s10972-011-9253-0
- Littleton, K., & Howe, C. (Eds.). (2010). *Educational dialogues: Understanding and promoting productive interaction*. London: Routledge.
- Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex Lessons.
- Mercer, N. & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. *Learning, Culture and Social Interaction* 1, 12-21. doi: 10.1016/j.lcsi.2012.03.001
- Scott, P. H., Mortimer, E. F., & Aguiar, D. G. (2006). The tension between authoritative and dialogic discourse: A fundamental characteristic of meaning making interactions in high school science lessons. *Science Education*, 90, 605-631.
- Walsh, S. (2006). *Investigating classroom discourse*. Routledge Taylor & Francis Group: London