Classroom questioning: teachers’ perceptions and practices

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Abstract

Moving from a teacher-centered teaching to a student-centered teaching implies a new perspective of the approaches to questioning. Putting the focus on students’ questions rather then on teacher’s questions, and valuing students’ questions rather then emphasizing their responses is imperative in supporting learners’ higher levels of thinking. This paper outlines and action research study with 3 secondary biology teachers and their students. A 2-month course of professional development was designed and implemented as a strategy to promote teachers’ classroom questioning awareness. Important changes in beliefs and practices were found after the intervention, particularly in what concerns the wait-time, the number and the kind of questions asked, both by teachers and students.

Keywords: Questioning; classroom questioning; science teaching; course of professional development.

1. Introduction

Research on the importance of questioning as a teaching and learning strategy is well documented (Almeida, Pedrosa de Jesus and Watts, 2008, Chin and Osborne, 2008; Graesser and Olde, 2003). It is suggested that teachers spend up to 50% of class time on questioning and that they ask between 300 and 400 questions a day (Levin and Long, 1981), while each student asks, on average, 1 question per week (Graesser & Person, 1994). Surprisingly, teachers seem to be not aware of this discrepancy. Several studies also rely on the kind of questions asked by teachers and students, concluding that these are usually procedural and fact-based (e.g. Brown and Edmondson, 1985). This particular study aimed at promoting teachers’ classroom questioning awareness through their involvement on a course of professional development (CPD).

2. Overview of the literature

2.1. Teacher’s questioning

Research has shown that teachers ask a high frequency of questions. In 1967, Schreiber found that fifth grade
teachers asked about 64 questions each during 30-minute social studies lessons. Floyd (1960) developed a study with 40 elementary teachers and found that these teachers asked 93 percent of all classroom questions. These numbers confirm the results obtained by Stevens in her precursor study about classroom questioning conducted in 1912. More recently, Kerry (2002) reinforces these numbers referring that if teachers ask an average of 43.6 questions per hour, in an average career they are likely to ask about 2 million questions.

Even if teachers ask a huge number of questions per class, the questions posed are consistently of the same kind. Teachers ask typically low level questions, requiring mainly memory. The finding of teachers’ characteristic use of low-cognitive-level questions has been verified in all school levels (from elementary teaching to university) and in a variety of subject areas.

Bearing in mind that teachers spend a large percentage of their communication time asking questions it is pertinent to ask: why do teachers ask questions? What are the functions of teachers’ questions? According to Brown and Edmondson (1985), teachers use questioning fundamentally to check understanding and knowledge to aid teaching, to diagnose students’ difficulties, to recall facts, to test knowledge, to direct attention and to maintain control. Research has consistently showed that the most frequent function of teachers’ questions is ‘recall’ – usually 60 per cent or more of all teachers’ questions. Management questions may vary between 12 and 30 per cent (Kerry, 2002).

Thus, the remaining percentage of teachers’ questions when we exclude recall and management questions is surprisingly small. Consequently, other functions associated to teachers’ questioning such as encouraging students to think, arousing interest and curiosity, developing students’ reflection and stimulate students to ask questions of their own are not frequently found on classroom questioning.

2.1.1. Wait-time

The wait-time is essential to student thinking. By wait-time we refer to the amount of time a teacher allots for student reflection after asking a question and before a student responds (wait-time I) and to the pause after a respondent offers a response (wait-time II). In her investigations, Rowe (1986) found that the mean wait-time was, on average, one second or less. If the student did not answered in one second, the teacher would repeat or rephrase the question, ask another question or call another student. After receiving a response, the teacher waited approximately 0.9 seconds before reacting and asking another question.

Rowe (1986) trained the teachers to increase their wait time to three to five seconds and found that the quantity and quality of students’ answers improved significantly: students give longer responses, students give more evidence for their ideas and conclusions, students speculate and hypothesize more and more students participated in responding. Furthermore, students ask more questions and talk more to other students.

2.2. Students’ questioning

Even if the frequency of students’ questions is usually low, in recent years there has been an increasing emphasis on the role that students’ questions play in learning science (Almeida, et al, 2008, Chin and Osborne, 2008; Graesser and Olde, 2003), as questions are an essential component of discursive activity and dialectical thinking.

The act of questioning encourages learners to engage in critical reasoning. Given that asking questions is fundamental to science and scientific inquiry, Zoller et al. (1987) argue that the development of students’ abilities to ask questions, reason, problem-solve, and think critically should become a central focus of science education reform.

Students’ questions result form a gap or discrepancy in the students' knowledge or a desire to extend their knowledge in some direction. Students' questions may be triggered by unknown words or inconsistencies between the students' knowledge and the new information, which then engender 'cognitive disequilibrium' (Graesser and Olde, 2003). According to these authors 'questions are asked when individuals are confronted with obstacles to goals, anomalous events, contradictions, discrepancies, salient contrasts, obvious gaps in knowledge, expectation violations, and decisions that require discrimination among equally attractive alternatives' (2003, p.525).

Student-generated questions are an important element in the teaching and learning process, and play a significant role in motivating meaningful learning. Students' questions can serve different functions, namely:
- creating a culture of inquiry: an emphasis on students’ questions conveys the message that the science disciplines are areas where inquiry is a natural component and questions need constantly to be raised (Marbach-Ad and Sokolove, 2000);
- heightening conceptual understanding: learners’ questions can lead to improvement of understanding and to retention of the learning a student encounters. When students ask questions they are shaping and exposing their thoughts (Watts, et al., 1997). Students’ questions can be diagnostic of their learning, allowing teachers to recognise students’ alternative conceptions. This means that students’ questions provide opportunities for teachers’ insight into thinking and conceptual understanding;
- driving classroom interactions: teachers’ own thinking can be provoked and challenged by students’ questions (Watts, et al., 1997) which are highly effective in increasing student interest, enthusiasm and engagement [4, 24]. Question-asking fosters discussion and debate;
- promoting autonomous inquiry-based learning: teachers can promote the notion of autonomy in learning through the provision of opportunities for students to become questioners (Marbach-Ad and Sokolove, 2000).

While students' questions serve useful functions for learners, they are also helpful to teachers in prompting reflective thought and student engagement. Therefore, students' questions can be analyzed by distinguishing between the use of these questions in learning science and in teaching science.

3. Methodology

This study was conducted with a sample of three secondary biology teachers and their eighth grade students (n= 59). All teachers were respected members of their teaching communities and showed a willingness to share and examine their practices.

As a way of assisting these teachers to investigate their use of questioning, a 2-month CPD (from September to November 2009) about classroom questioning (teacher and student questioning) was developed and implemented. Course sessions were audio-recorded, and teachers were interviewed before and after this course. Sessions included analysis and discussion of literature, but relied mainly on analysis, reflection and discussion about each teacher’s questioning practices. Before the beginning of the CPD, each teacher was asked to audio-record and fully transcribe a 45-minute class of her own. Transcripts of the lessons were made and analyzed, with particular attention paid to interactions that involved questions. At the end of the CPD, the three teachers audio-recorded another class. Once again, all the classes were transcribed and analyzed. Teachers’ self-reflections were also collected and analyzed.

After the initial analysis of pre-CPD transcripts, the following themes emerged as fundamental: (i) classroom discourse pattern; (ii) cognitive level of teacher’s and students’ questions; and (iii) wait-time. These were the main topics discussed during the PDC sessions.

4. Results

4.1. Phase 1 – “Classroom discourse pattern” analysis of pre- and post-CPD data

A high rate of questioning was evident in the three lessons transcripts pre-CPD. Given a 45-minute lesson, the rate of teacher's questions was, on average, 2 questions per minute. On the other hand, the students asked about one question each three minutes. These results go along with the data reported in the literature (Wragg and Brown, 2001). The three teachers remarked in the first interview that they were surprised with the number of questions they asked. Furthermore, the teachers also thought that their students asked a lot more questions then they really did.

However, post-PCD, the average of teacher's questions decreased to 1.2 questions per minute, and the number of students' questions raised to one question per minute. This kind of result shows that when teachers are aware of their practices, they are able to change their questioning practices, namely through decreasing the number of questions posed and, consequently, giving more space and time for their students’ questions.

4.2. Phase 2 - “Cognitive level of questions” analysis of pre- and post-CPD data

The second phase of the CPD focused on the cognitive level of both teacher and student questioning. Questions were categorised as closed and open. Closed questions have one correct or 'best' answer or one from a narrow range
of answers. On the other hand, open questions are higher-level questions, permitting a wide range of responses; these can also include the expression of feelings or values (Almeida and Neri de Souza, 2009).

The majority of teachers' questions pre-CPD were categorized as closed questions (91%). 95% of students' questions were also classified as closed questions. However, post-CPD, teachers' closed questions decreased to 75% and students' closed questions decreased to 81%.

During the CPD, teachers were advised to prepare some higher-level questions before the class. During the second interview, the three teachers emphasized that they had prepared some open questions before implementation. These results also seem to confirm what we have found elsewhere (Almeida and Neri de Souza, 2009), that the kind of questions raised by the teacher seems to influence the kind of questions asked by the students. Here, when the number of teacher's open questions raised, the number of students' closed questions decreased.

4.3. Phase 3 – “Wait-time” analysis of pre- and post-PDC data

The teachers analyzed their classroom discourse according to whether they waited for (i) 2 or more seconds, or (ii) less than 2 seconds. The pre-training analysis of data for Wait-Time I showed that for 13% of the questions asked the teachers waited at least 2 seconds or more. The analysis of data for Wait-Time II revealed that, of the 270 questions raised by the three teachers, the teachers waited more than 2 seconds only for 26 questions.

After the CPD, the teachers waited more than 2 seconds for 38% of the questions raised. For Wait-Time II, for 32% of the questions asked, teachers waited for more than 2 seconds.

4.4. Teacher’s Reflections

Teachers were asked to write a reflection upon the effectiveness of the CPD. All participants found that the training program was effective for them as teachers and that it provided them with valuable new teaching strategies for promoting their students’ learning. All teachers referred to:

i) the importance of asking higher-level questions to enhance their students’ thinking and reasoning;
ii) the need to change their questioning practices and, consequently, to change their students’ questioning behaviors;
iii) the significance of providing enough wait time after asking a question;

The three teachers also agreed that audio recording, transcribing and analyzing their own classes was an effective strategy to make them aware of their questioning profiles and the kind of discourse that was produced in their classes. The teachers also considered this kind of strategy as an effective way to face their practices and deconstruct their erroneous perceptions about their questioning profiles and their students’ questioning profiles.

5. Discussion

Qualitative data from the interviews and from teachers’ reflections show that teachers were not aware about their questioning patterns. The three teachers believed that they asked a small percentage of all classroom questions, and that the majority of questions was raised by their students. Furthermore, all teachers thought that their students posed complex and difficult questions. They also believed that their own questions were higher-level questions. When confronted with the recordings and the transcripts, the three teachers were absolutely surprised with the reality.

Pre-CPD revealed that teachers lacked the skills and knowledge in all three phases of intervention. For instance, in Phase 2, with regard to the cognitive level of questions, the majority of the questions were formulated at the lower levels of Bloom’s taxonomy. With regard to Phase 1, the teacher initiated nearly all the interaction episodes by asking a question, with only a residual number initiated by the students. Similarly, Phase 3 pre-CPD data indicated that teachers did not wait for the students to respond before or after asking a question.
6. Conclusion

This study shows that, in what concerns the classroom questioning patterns, there is a mismatch between teachers’ perceptions and practices. The three participants lacked awareness and knowledge of the way they structured and processed their questioning episodes.

This study has highlighted the importance of carefully planning appropriate questions before implementation as well as the facilitation of student-initiated interaction episodes. If learning is to be promoted in ways congruent with contemporary learning theories then training teachers to ask higher-level questions in appropriate ways is crucial. In their written reflections and also during the interviews, the teachers signaled that they were not aware of the importance of using effective questions as a valuable teaching technique. We believe that it is crucial to include this subject on student teachers curriculum and on in-service teacher training programs, so that teachers can be aware of the importance of classroom questioning and can be offered the strategies and tools to improve their questioning practices and, ultimately, improve their students’ learning experience.

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