

Quality questioning in undergraduate biology: a way to promote professional development

Abstract

Research on questioning in education claims that true enquiry environments have the potential of influencing positively the quality of teaching and learning. It is also well established that the majority of questions are asked by teachers, frequently at low cognitive level. Even, when higher cognitive questions arise, teachers may adopt complementary pedagogical behaviors that discourage students to express their thoughts, jeopardizing quality learning.

The study reported here is part of a broader one aiming at understanding the relationship between teacher questioning practices and their concepts of teaching and learning in Microbiology and Evolution. According to Trigwell and co-workers research (Trigwell, Prosser & Taylor, 1994), used as a theoretical reference, there is an internal relationship between teachers' conceptions and the adopted teaching practices.

Our aim was to investigate how a group of five University biology teachers were able to deal and integrate some pedagogical suggestions for promoting questioning when lecturing undergraduates. They were accompanied during an entire academic year (2009/2010) and data was gathered by: i) non-participant lectures observation; ii) three semi-structured interviews and iii) application of a Portuguese validated version of the Approaches to Teaching Inventory (Trigwell, Prosser & Ginns, 2005).

First findings indicate that it was quite different the way each teacher managed to implement the same strategy. Data also suggest that the observed practices are related to different conceptualizations of 'questions' functionality', rooted in different teaching conceptions.

Key-words: Questioning, Undergraduate Science, Preferential Teaching Approaches, Professional development

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Theoretical framework and Rationale

Several studies indicate that the formulation of questions stimulates reasoning and reflection, being also useful in the organization of specific tasks (Chin & Osborne, 2008). Indeed questioning has the potential of being a powerful ‘pedagogical tool’ (Macaro, 2005) for enhancing quality interaction between teachers and students. Grasser and Person (1994) stated that 96% of the questions formulated during classes are from teachers. This imbalance between teacher and students’ questions has been verified across all school levels, including in Higher Education (Author, 2004), being the majority of teacher questions at low cognitive level (Author, 2009). Even when teachers pose high cognitive level questions, they may not display ‘proper’ pedagogic behavior, discouraging students to express their thoughts and contribute for discussion (Günel, 2008).

Research involving teaching ‘styles’ or ‘approaches’ recognize a relationship between lecturers’ concepts, beliefs or motivations and the adopted practices (Eley, 2006; Kane, Sandretto & Heath, 2002; Norton et al. 2005). For example, Trigwell and co-workers (Trigwell, Prosser & Taylor, 1994) based on a phenomenographic analysis of interview transcripts of 24 first year lecturers, identified a rank of five preferential teaching approaches (PTA), in terms of different teaching conceptions and adopted strategies. The two extremes were designated as: ITTF – Information Transmission Teacher Focused and CCSF – Conceptual Change Student Focused. At the ‘teacher focused’ pole, learning is perceived as ‘information acquisition’ being driven and assessed by external factors to the students, while teaching is focused on the syllabus or the textbook. At the ‘student focused’ pole, learning is discussed in terms of developing personal meaning through conceptual development and/or change, while teaching is perceived as supporting students in this process. The same research group developed an instrument that allows the identification of the teacher’s PTA in a specific context. The most recent version of this instrument is called the *Revised Approaches to Teaching Inventory*, or simply *ATI-R* (Trigwell, Prosser & Ginns, 2005).

Taking Trigwell and co-workers research as a theoretical framework, the rationale is that teachers with opposite PTA also have different forms of conceptualizing questioning, therefore different ways of using questions during lectures. In order to promote quality questioning at university level the first step should be to understand how university staff actually deals with questions according to their knowledge, concepts and beliefs. Previous study with a group of five university academics teaching biology to undergraduates at a Portuguese University revealed that ITTF teachers self-answer more frequently to their own questions when facing the absence of a solicited student answer than their CCSF colleagues. These CCSF teachers were also more able to manage in a dialogic way (Mortimer & Scott, 2003) with students’ questions and answers, engaging with the expressed student’s reasoning, in order to achieve shared meaning (Author, 2010).

Main aim and research question

In order to understand more deeply the relationship between teaching conceptions and teachers questioning practices, it was decided to investigate how teachers with opposite PTA deal with specific pedagogical suggestions involving the promotion of questioning during lectures. The research questions are the following: (i) How does each teacher react to those suggestions? What are their main concerns, doubts or comments? (ii) How does each teacher manage to implement the innovative teaching strategies? (iii) What is the individual final evaluation of the entire process? (iv) Is it possible to identify an internal relationship between teaching and learning conceptions and questioning practices?

Methodology of the study

The same group of five biology teachers, collaborating with us since 2007 in an earlier phase of the project, were challenged during the first interview (semi-structured interview) of the academic year 2009/2010, to implement two innovative teaching strategies: a) At the end of every lecture they should ask students to write, at least, two questions/doubts and then they should integrate the discussion of the collected questions during the introduction of the following lecture; b) During one lecture, each professor should also try to maximize dialogic reactions to students' interventions. This particular lecture was prepared with a task-based interview (Koichu & Harel, 2007). During this second interview moment, each professor was asked to reflect on some questioning practices using transcripts of their lectures dialogues.

All teachers' lectures were observed (a mean of six lessons per teacher), filling in an observation grid developed for that purpose. For further discourse analysis, focused on teacher questioning practices, each lecture was also audio taped and fully transcribed. In order to evaluate the implementation of these strategies, at the end of the year teachers were again interviewed (third interview). All interviews were audio-taped and fully transcribed. Transcripts are being subjected to content analysis using software N'Vivo 7.

Finally, each professor responded to a validated Portuguese version of the Approaches to Teaching Inventory (ATI) in order to cross data gathered with their PTA and the corresponding conceptions of teaching and learning in Microbiology and Evolution.

Main Results

Although the full data analysis is still in progress, some findings can already be described:

(i) The two teachers with a preferential ITTF approach seemed to have more difficulties to implement 'innovations' than their CCSF colleagues, asking frequently for help and 'instructions'. One of them has preferred that students would write the questions down at home, in order to avoid time 'wasting'. The other ITTF colleague was very much concerned about her performance, being worried that she wouldn't be able fulfill the 'request'. The three teachers identified as having a CCSF teaching approach dealt with suggestion quiet easily, being very enthusiastic about the challenge. No major concerns were expressed.

(ii) On what concerns the implementation of the suggestion (a), one of the CCSF academics stands out on stimulating students' questions. This teacher started to adapt and extend the suggested strategy by planning the introduction of specific images and small texts in the PowerPoint presentations used during lecture. On contrary, one ITTF teacher expressed frequently her concern about the type of questions that were asked, stating frequently to students that they were evidencing serious 'lack of study'. Sometimes this teacher even tried to identify the author of a particularly 'bad' question. We believe that this reaction might explain the decrease of written questions delivered by students throughout the year. Considering strategy (b), ITTF teachers increased a lot the number of questions, trying to interact more with students. However, only one of them managed to achieve this purpose, since the other colleague started to self-answer even more times to her own questions. Consequently 'real' interaction moments within her lectures, remained very low. During lectures, it was very obvious the effort of one of the CCSF teachers, in waiting longer for a student answer. Follow up questions after a student answer, in order to explore more deeply the expressed reasoning, also increased with this teacher.

(iii) Finally, all five teachers valued these enquiry enhancing strategies. However, only the CCSF teachers used concrete examples of their lectures to exemplify the positive benefits on the quality of teaching and learning Microbiology and Evolution. Besides that, one of them stressed out that these experiences are time consuming and only possible when an 'external stimulus', like somebody from education (an assistant in pedagogy, as he called) is present, giving 'ideas' and feedback.

Conclusions and Implications

One aim of this study was to explore how each teacher deals with the implementation of suggested innovative strategies, taking into account their PTA. The suggestions envisaged to promote interaction (through questions) during undergraduate Microbiology and Evolution lectures, by a group of five biology professors. During the process, there were evidences showing ‘different teachers’ dealing ‘differently’ with the same suggestions. This may be due to distinct conceptions and beliefs about teaching those specific subjects, identified either by ATI results and interview data. These outcomes could provide important insights for the design of continuing professional development at university level. For instance, since CCSF teachers revealed to conceptualize questioning in a more student centered way, being more successful in implementing strategies that promote quality questioning, we believe that professional development strategies should integrate collaborative work between teachers with opposite PTA’s. Peer lecture observation, followed by reflections on observed behaviors would be one possibility.

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