Exploring Teaching and Learning Conceptions and Questioning Intentions of Biology University Teachers

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Abstract

Many researches on teaching in higher education report an internal relationship between teaching and learning conceptions and the adopted teaching practices. The present study is part of a broader research project aiming at understanding more deeply the relationship between teachers' conceptions, beliefs and motivations and their questioning practices, taking into account the intentions beneath these particular instructional behaviour. Following the stated research purpose, and using as a theoretical reference the concept of Preferential Teaching Approach (PTA), five University teachers, lecturing biology undergraduates, were accompanied during an entire academic year (2010/2011). Data was collected by non participant lecture observation, regular informal meetings and three interviews. All these moments were audio-taped and verbatim transcribed for further analysis. This paper reports work in progress and focuses on the qualitative analysis of data gathered by one task-based interview where teachers were asked to categorize particular Teacher Questioning Practice (TQP), using lecture dialogue transcripts, in order to trigger and support their reflection about questioning. By adopting mainly a 'template analysis' approach (Robson, 2002) it is intended to identify and describe the main aspects focused by each teacher during the interview in order to explore more systematically their questioning intentions during undergraduate biology lectures. Findings are being crossed with teacher's teaching and learning conceptions, already identified and described in previous work (Pedrosa de Jesus & Silva Lopes, 2009), and reconfirmed in this particular study through the application of the Portuguese validated version of the Revised Approaches to Teaching Inventory (ATI-R) to each teacher. First results reveal that lecturers with opposite PTA, therefore different teaching and learning conceptions, focus on distinct advantages and purposes for teacher's and students' questions. These outcomes seem to be rooted on distinct conceptualizations of 'questions functionality', leading to different questioning intentions when interacting with students. These intentions were called: *Product oriented questioning focused on teachers' benefits* and *Process oriented questioning focused on conceptual sharing* between teacher and students. Considering that research on questioning evidences that teachers' questions play a relevant role on the quality of the teaching-learning processes, we believe that the discussion of these five cases provides important insights, contributing for a better understanding of this complex pedagogical practice. Relevant outputs for designing strategies for professional development, aiming at promoting quality teaching at university level, are also identified.

Keywords: Teaching and Learning conceptions, higher education, questioning, task-based interview, professional development

1. Introduction

1.1 Teaching in higher education – research on 'theory' and 'practice'

A strong body of literature concerning research studies about teaching in higher education evidence an internal relationship between 'teaching conceptions' and 'theories of action' (Norton et al., 2005; Oosterheert & Vermunt, 2001; Kane, Sandretto & Heath, 2002). Similar findings were reported by Kember and co-workers (Gow and Kember, 1993; Kember and Kwan, 2000) recognizing strong relations between the orientation (concept) to teaching and the adopted teaching and assessment methods. Indeed, at a conceptual level, teacher's beliefs ('theory') and instructional behaviour ('practice') seem to be interrelated (Barak & Shakman, 2008), and can therefore be used to infer about each other.

Self-reported practices of university teachers have also revealed the usefulness of inferring about teaching and learning conceptions. For example, Trigwell and colleagues have been investigating preferential teaching approaches (PTA) in the context of Higher Education. One of their first works (Trigwell & Prosser, 1993) focused on the phenomenological analysis of twenty four interview transcripts of first year lecturers

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Findings allowed the identification and description of five different approaches to teaching, each 'type' aligned with different teaching and learning conceptions. At the 'Information Transmission Teacher Focused – ITTF' pole, teaching is based on the transmission of contents from the syllabus or the textbook, and learning is perceived as 'information acquisition', driven and assessed by external factors to the students. At the other pole, the 'Conceptual Change Student Focused - CCSF' approach, learning is discussed in terms of developing personal meaning through conceptual development and/or change, while teaching is perceived as supporting the students in this process (Trigwell & Prosser, 1996; Trigwell & Prosser, 2004). According to these authors, *conception*s influence teaching *intentions* and consequently 'drive' the adoption of specific teaching practices. Considering this internal relationship, Trigwell and co-workers developed an instrument – the Approaches to Teaching Inventory (ATI) – that allows the identification of the preferential teaching approach, and therefore teaching and learning conceptions. The most recent version of this instrument (Trigwell, Prosser & Ginns, 2005) includes twenty two sentences, describing each one a specific teaching intention and/or teaching strategy. Although unknown to the respondent, each sentence reflects one of the two 'opposite' teaching conceptualizations. Teachers are asked to focus on a specific discipline, course or subject and to place themselves for each item on a Likert scale from one (rarely) to five (always). PTA identification is based on the mean numeric response to the twenty sentences of the inventory.

1.2 Teachers' questioning practices (TQP) and preferential teaching approaches (PTA)

The promotion of a true spirit of inquiry can improve the quality of teaching and, consequently, the quality of learning (Chin, 2007; Chin & Osborne, 2008; Pedrosa de Jesus & Moreira, 2009). Several studies show that questions could help to scaffold ideas, organize tasks and encourage reflection (Watts & Pedrosa de Jesus, 2006).

On what concerns teachers' questions, Gunel (2008) defined them as a complex 'pedagogical practice' reporting a variety of questioning behaviours taking into account complementary features, such as *wait-time, cognitive level* and *body language*. Indeed, different teachers seem to use questions during classes in different ways. It is argued that these observed differences might be rooted in different concepts and beliefs of the teachers (Barak & Shakman, 2008).

Taking into account the relevance of the questioning processes[1] in the quality of teaching and learning, and the lack of empirical evidence confirming the internal relationship between teaching conceptions and instructional practices, namely questioning, a research project involving the observation of a group of five university teachers in natural lecture settings was designed and implemented during two following academic years. Findings allowed to identify a relationship between particular questioning practices (Table 1) and Preferential Teaching approaches: ITTF teachers were identified as using lower percentages of self-answers than their CCSF colleagues, having also less success in obtaining a student intervention, particularly student questions. Higher frequencies of students' participation with CCSF teachers seem to be related to the fact that these teachers had more often a more cognitive stimulating attitude towards students' interventions (Pedrosa & Silva Lopes, 2009). Therefore, the outputs of this project allowed reinforcing the complementary relationship between teaching conceptions and the adopted teaching practices, such as questioning (Pedrosa-de-Jesus & Silva Lopes, 2011). Based on these results it is believed that TQP can be a useful indicator of the main PTA of a university teacher and, consequently, his teaching and learning conceptions (Table 2).

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[1] Our understanding of the importance of question in the quality of Teaching and Learning process is rooted on Clarks' (1996) concept of 'joint action'. In order to understand more deeply the pedagogical implications of questions it is important to go beyond 'isolated' interrogation, moving from question to 'questioning'. In this sense, it is important to analyse not only the questions *per se* but also the behaviours that the formulation of one question induce on others. Consequently, it matters to look at the *questions and* the obtained *answers*. Behaviours that emerge when a solicited answer is not obtained are also revelant.

Table 1: Main categories of TQP (agreement percentage of respondent validation over 85% - Pedrosa-de-Jesus & da Silva Lopes, 2009)

Event	TQP – main description
Absence of a solicited student answer	*Re-iniation effort:* the teacher repeats the question or reformulates it, maintaining or lowering the difficulty level of the previous question.
	Self-answer: the teacher answers to his/her own question, continuing with the discourse or moving to another question.
Student answer	*Dialogic reaction (Feedback):* the teacher engages with the expressed student's reasoning (independently of the scientific correctness of the answer), stimulating the students' intellect.
	Non dialogic reaction (Feedback): Scientific correctness of the answer might be evaluated, but the teacher does not explore the students' reasoning/idea/perspective and does not stimulate further reasoning. The teacher doesn´t engage in generating new and shared meaning.
Student question	*Dialogic reaction:* the teacher engages with the expressed student's reasoning (independently of the scientific correctness of the answer), stimulating the students' intellect.
	Non-dialogic reaction: Scientific correctness of the question might be evaluated, but the teacher does not explore the students' reasoning/idea/perspective and does not stimulate further reasoning, generating new and shared meaning.

Table 2: The relationship between teaching and learning conceptions, preferential teaching approaches and questioning practices (based on *Prosser, Trigwell & Taylor, 1994 and ** Pedrosa-de-Jesus & da Silva Lopes, 2011).

PTA	Theory/'Cognition'			Practice (teacher questioning practice - TQP)	
	Learning Concept*	*Teaching Concept**	*Teaching intention**	*Self-Reported questioning (Indirect observation)**	*Observed Teacher questioning (Direct observation)***
ITTF	Accumulating information with the aim of accomplishing external demands	Transmitting information ('teaching by telling')	Students acquire the contents of the discipline, being able to connect them.	Teachers refer when students asks a question, they answer the question, not changing the planed structure of the lesson.	Higher Frequency of self-answers Re-iniation efforts commonly with lower level of difficulty (inducing the answer) Very high frequency of non dialogic reactions to students interventions, particularly questions
CCSF	Construct personal knowledge by confronting and changing perception of concepts.	Support students in developing and changing their concepts	Creating opportunities of confronting and changing students' perception in order to help them to construct their knowledge.	Teacher stated that student questions are an important element of the lesson. The teacher encourages questions and uses them to interact with students.	Very low frequency of self-answers Re-iniation efforts are frequently of the same level of difficulty Frequent dialogic reaction, particularly to students answers

2. The present study

2.1. Contextualization

The work reported here is part of a broader naturalistic research project implemented in the context of undergraduate biology courses of a Portuguese university, aiming at promoting conceptions and instructional practices that integrate the valorization and development of teachers' and students' questioning skills. Considering that the intention is to investigate teaching and learning processes in natural settings, such as 'real' lectures, a Co-researcher Model (Macaro & Mutton, 2002) was adopted, implying a close collaboration between education researchers and a group of five university teachers (designated as Teachers A,B,C,D and E).

The design of the global research follows a qualitative (Tuckmann, 1999; Cohen, Manion and Morrison, 2003) or flexible (Robson, 2002) approach. Data has been gathered mainly by:

a) Lectures observation: one science education researcher acts mainly as a non-participant observer, annotating relevant teacher's and student's behaviours in a grid designed for this particular research project (Pedrosa de Jesus & Da Silva Lopes, 2009). Occasionally, non-participant observation switched to participant observation due to specific teacher solicitations.

b) Semi-structured interviews to teachers and students before, during and after the semester. Verbal discourse from lectures and interviews was audio-taped and has been verbatim transcribed in order to allow a more detailed data analysis.

Considering the close and 'daily' collaboration between the teachers and the researchers, many opportunities emerged to gather data, in a more 'informal' way, for example the e-mail correspondence and the 'quick chats' between lectures. Taken into account the richness and authenticity of this type of data, one of the researchers has been writing a *research journal* (Robson, 2002) in order to keep a detailed record of these collaboration moments. Due to the extended involvements with the teachers, the educational researchers ended up fully immersed in the day-to-day life with the lecturers being studied. These characteristics and conditions also confer ethnographic features to this research project (Robson 2002; Tuckman, 1999).

2.2. Main aim and research questions

Findings from previous research allowed the identification and description of a relationship between Preferential Teaching Approaches (PTA), Teaching and Learning Conceptions and Teacher Questioning Practices (Pedrosa de Jesus & Silva Lopes, 2011). However, drawing from Maxwell's (1992) 'types of understanding', much work has still to be done in order to deepen the level of interpretation and explanation of the identified PTA and TQP patterns. We believe that it is only through capturing and understanding the 'whole picture' of the individuals and the context that is being studied, that is it possible to have a chance to effectively promote quality questioning at university level.

Work in progress leads us to the design of a particular interview strategy in order to create the opportunity to explore teachers' understanding and conceptualization of the questioning processes in the context of their lectures. Based on the stated research purpose, the following research questions were defined:

- What are the main aspects identified by the teachers, when asked to reflect about the questioning processes (teacher and students) in the context of their lectures?

- Is it possible to establish a relationship between the expressed teachers' questioning intentions and their preferential teaching approaches (and therefore their teaching conceptions)?

2.3. Methodology

2.3.1. Data gathering

In order to confirm the teachers' PTA, therefore their main teaching conceptions, each teacher responded to a Portuguese validated version of the ATI (Pedrosa de Jesus, Silva Lopes & Watts, 2008). The aim was to cross this quantitative data with the qualitative data obtained by one particular semi-structured interview with each teacher, conducted at the end of the academic year of 2009/2010. Each interview had a mean duration of ninety minutes and was audio-taped, following the same design identified as 'task based' approach (Koichu & Harel, 2007). During this type of interview, the whole 'interrogation' process is based on the fulfillment of a particular task by the interviewee consisting, in this particular study, the categorization of the teacher questioning practices (TQP) by reading five lecture transcripts[2]. The interview was organized into two main moments. First the interviewer identified the main purpose of the interview, delivering and explaining the organization of a written document integrating the description of the adopted TQP categorization system (Pedrosa & Silva Lopes, 2009) and the five lecture-dialogue transcripts (see Figure 3). After this, each teacher was asked to read the first dialogue for himself and then to 'think out loud' during the categorization exercise. Based on the expressed reasoning the interviewer asked particular follow-up questions. This process was then repeated with the remaining four dialogues. Teachers were free to express any doubt or to comment any aspect whenever they considered it important. Some interview questions were common to all teachers (such as: *'In the dialogue transcript what is your comment about the way the teacher deals with the students' non-answers?', 'How do you feel with the students' silence after one of your questions*?'), other emerged as a particular output of the ideas and meanings that were being shared during the interview process, as the following excerpt illustrates:

Teacher A (reading lecture dialogue 1) – I don´t think that we can consider this behaviour a feedback. The teacher…is trying to make him [the student] talk more, but he didn´t say to him if his answer is correct or wrong.

Interviewer – What do you mean by that?

Teacher A – I understand what the teacher is doing here…he is trying to explore other reasoning with the students…but well…*first you have to say if the reasoning is correct or not*. You might say "No, what you say is wrong. Let us explore this reasoning...*"*

Interviewer – So*, you think that the evaluation of the scientific correctness (right or wrong) is important…*?!

Teacher A – Yes.

Interviewer - Can we say that informing about the scientific correctness of a question/answer stands for the definition of 'giving feedback'? Do you agree with this statement?

Teacher A – Yes, exactly. We have to confirm to the student what he is saying is scientifically correct or not. And if it is wrong we, as teachers, have to correct it.

2.3.2. Content analysis of the interview transcripts: the template approach

Interview transcripts are being subjected to content analysis, supported by the NVivo 9 software. Considering that key-codes were determined both on a priori bases (derived from theory and research questions) and from an initial read of data, the adopted analysis approach can be identified as a *template approach* (Robson, 2002). In order to obtain the first holistic impression, we have started by a global reading of the five transcripts. Insights emerging from this 'diagonal reading' were annotated, a procedure designated as *memoing* (Robson, 2002). The same procedure is being adopted along the entire process of analysis transcripts. Combining the initial reading with the literature findings,

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[2] The five dialogues that were used correspond to excerpts of lecture's dialogue transcripts of previously observed lectures from the same group of teachers. The same five episodes were used with all teachers. None of the episodes was identified. The adopted TQP categorization system refers to the one described in Table 1.

integrating the conceptual framework of the present study, namely the investigation related to the concept of PTA, a set of initial key-codes, or template, were defined (see Figure 4). Naturally, this template has been 'evolving' throughout the reading and reflection process: new codes and sub-codes emerged and were integrated. The establishment of new codes implied repeating the reading of the previous transcripts in order to minimize *bias* by excluding relevant thoughts expressed by the teachers. For instance, the adoption of a specific categorization during the reading of the third interview, implied to reread the first and second interviews in order to make sure that the information that lead to the definition of a new code wasn't present in any earlier read transcript, having been overseen. Once the analysis of the individual transcripts is completed it is planned to proceed with a more complex *matrix analysis* (Robson, 2002), integrating the use of network maps, flow charts and diagrams.

3. Preliminary Findings - an interim summary

To enrich the analysis and reduce threats to validity (Garrison et al., 2001; Robson, 2002) the interview data are being crossed with the mean numeric response of the teachers to the Portuguese version of the ATI (Table 4). The identification of the PTA of each teacher allows to complement the analysis with the corresponding teaching and learning conception, already described in previous studies (Pedrosa de Jesus, Lopes & Watts 2008; Pedrosa de Jesus & Silva Lopes, 2011).

As previously stated, content analysis of all interview transcripts is still being undertaken. Data from Teacher E will be excluded from the discussion of the preliminary findings since this interview transcript is not completely analysed,

Due to the ethnographical nature of this study and the prolonged involvement of the five teachers with the educational researchers, we would like to emphasise that the insights and knowledge obtained from other strategies, which are not reported here, increase our trust about what has been found so far, which is briefly described in the following sections.

3.1. Teachers' expressed thoughts about questioning

3.1.1. Teacher questions

Both teachers identified as having an ITTF approach, indicating that they conceptualize learning as 'transmitting contents', stated that they ask the majority of the questions at the beginning of the lecture, in order to quickly review the contents covered in last lecture and to see if *'students had done their work at home'* (Teacher A). It was also stated that frequently they don't obtain any (correct) student answer, because students are *immature* (Teacher B) and *'they just study at the eve of the exam'* (Teacher B). On contrary, both CCSF teachers, and particularly teacher D, stressed out the fact that they try to question students throughout the lecture, in order to *'make them talk with each other'* (Teacher D). Teacher C went further on his reflection and stated *"I use questions to crystallise students' understanding...and to make the knowledge of one student concrete to other students...I would like that students would have always present the implications of what is said...which knowledge is related and ... constitutes the basis of one short answer...where does it fit...what is beneath and beyond that answer ... that particular reasoning"*.

While ITTF teachers explained the low frequency of students' answers by focusing on students' characteristics, both CCSF teachers tended to focus their attention on the difficulty to resist the temptation in self-answering the question. Interestingly, the teacher identified in previous studies (Pedrosa de Jesus & Silva Lopes, 2011) as the teacher that used less self-answers (Teacher C), was the most self-critical during the task-based interview, stating *"I have always the feeling that I am self-answering to my questions. Frequently while I am lecturing I think...ok there...I am again answering to myself! ... but sometimes it takes so long for students to answer!"*

Figure 3: Example of a TQP categorization sheet of the task based interview

Teacher-Student Dialogue (Topic – Sterilization techniques)	Lign
T: Tell me, what type of substance can be sterilized in damp heat?	I
Std: Culture media.	II
T: Exactly. You already talked about this in laboratory classes. Give me an example of a solution that has to be sterilized by filtering.	III
Std: X	IV
T: You don't remember anything? Well I remember one thing, that you aren't studying. Try to remember what was said in the laboratory session…	V
Std: The solutions if they went to dry heat, it wouldn't,,this is/ (teacher interrupts the student)	VI
T: /No. That we have already talked, for example sterilization of culture media. Now the solutions that are sensible to the heat can't go, much lesser to damp heat, isn't it so?! Give me two examples of solution.	VII
Std: X	VIII
T: Or just one example if you prefer. What was the example I gave you?	IX
Std: X	X
T: Vitamins and antibiotics.	XI

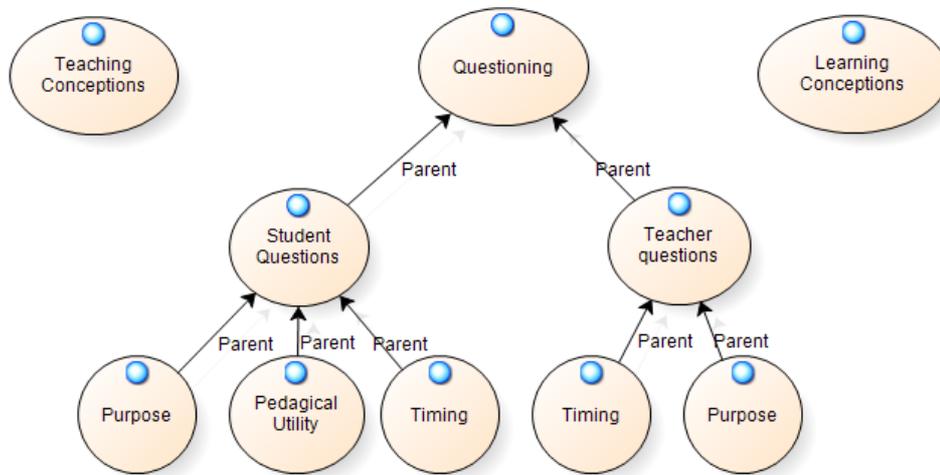| I my opinion the following TQP are present	Please put a cross (X)	Please identify the lign (eg.I)
Re-initiation effort		
Self-answer		
Non dialogic feedback (this is reaction to a student answer)		
Non dialogic reaction to student question		
Other behavior*		

*Please specify:

_____

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Figure 4: Starting template adopted for the content analysis of the five interview transcripts.

Table 5 : ATI results of the five teachers participating in the research.

PTA Poles*	Teacher				
	A	B	C	D	E
ITTF	**4.0**	**4.0**	3.5	3.2	3.5
CCSF	3.4	3.7	**4.2**	**4.0**	**4.3**

*Results based on the mean numeric response for each pole.

On what concerns the feedback that teachers give to students when they answer a teacher question, both ITTF teachers focused again their attention on the scientific correctness of the student answer and the *'possibility to check knowledge acquisition'* (Teacher B). On the contrary to their CCSF colleagues, the two ITTF teachers focused their attention on the teacher: *"When the answer is correct I say. 'That is correct!', when the answer is wrong I correct the answer and move on. That is what I do...".* The focus of teacher D was clearly on students: *"First of all I try that the students give the feedback. Not me. Because when the teacher talks and says 'I think this or that' … well then everybody thinks like me...because whatever I say seems to be understood as the 'holy truth'. I don't like this. Sometimes I think I could say nonesense the entire lecture...nobody would say anything. One day I will make this experience to see how long it takes for one student to disagree with me. (laughs)".*

3.1.2. Students' questions

On what concerns students' questions, all teachers emphasized their appreciation when they are able to do so, because they are an indicator of students' interest and motivation. Both ITTF teachers emphasise the fact of trying to answer the question immediately, except when they don't really know the answer and have to do some research first. Interestingly, both teacher also ended up referring the 'timing' where students questions were more frequent, namely at the eve of the exam: *'because that is the moment where they finally started to study'* (Teacher B) and *'they ask those questions mainly to see if the teacher 'drops' some information about the test'* (Teacher A). This concern was not verbalized by the two CCSF teachers. However, when the interviewer asked each one if the students ask more questions at the eve of the exam, both agreed. Indeed, these teachers devaluate that

particular student behaviour, considering it *'normal'* (Teacher D). On the contrary, teacher A (ITTF) emphasised it repeatedly during the interview, expressing his frustration.

Finally, Teacher D stands out by stressing that he makes a *'real effort'* for stimulating other students to answer to their peers' doubt (instead of him), stating that students' questions are *'very positive and useful to stimulate other students to think and talk'*. Teacher C, for instance, focused on the information that he was able to obtain through a student question and the reasoning he is making: *"the reasoning expressed by a questions is more genuine because it don't follow the traditional book format ... some students' questions are, year after year, the same...which is interesting to reflect on...what does this say about their previous knowledge, their understanding schemata?"*

3.1.3. Interpretation of the expressed thoughts – Inferring questioning intentions

Expressed thoughts about questioning seem to be coherent with the teaching and learning conceptions of both preferential teaching approaches (ITTF vs. CCSF) and also coherent with the observed teacher questioning practices described in a previous study (Pedrosa de Jesus & Silva Lopes, 2011).

Both CCSF teachers state that questions are useful to accommodate students' contribution and to understand, explore and elicit students thinking in order to construct, or at least recall, their *'knowledge foundations'* (Teacher C). Questions seem to be conceptualized as an instrument that creates an opportunity to share knowledge and meaning, being the starting point for teacher-student or student-student interaction. On the other hand, both ITTF teachers tend to focus not on the process but more on the product, this is knowledge acquisition itself: teacher questions are there to be answered by students, and student answers are formulated in order to be evaluated by the teacher considering their scientific correctness. Therefore, questions are the ending point of a teaching-learning process, since they are used to 'verify' (by the teacher) or to 'accomplish' (by the students) external demands.

3.2. Looking beyond questioning intentions – relevant insights for continuing professional development (CPD) strategies

The teachers' espoused reflection during the task based interviews allowed us to perceive that they had stronger reactions when reading episodes where teachers had an opposite PTA, therefore teaching and learning conceptions. Despite the fact that the teachers didn't know which teacher was involved in each episode, therefore ignoring the corresponding PTA, it was clear that they didn't identify themselves with the questioning practices of teachers whose PTA doesn't match with their own PTA.

It is also important to emphasise the strong positive teachers' reaction towards the task based interview methodology. All of them stated that it was a very interesting experience, since it supported them on their reflection exercise by using 'concrete' examples of their own lectures.

It is believed that the design of professional development strategies which include the creation of opportunities for lecturers to analyse and discuss specific 'classroom practices' (such as questioning), particularly with mixed groups (this is, including ITTF *and* CCSF teachers), has great methodological potential for prompting teachers reflection even in higher education.

4. Concluding remarks

This report is aiming at exploring the main questioning intentions of teachers with different PTA and, therefore, teaching and learning conceptions. In order to chart and justify the obtained findings (Robson, 2002), a detailed description of the task based interview as a main adopted methodology, preceded the discussion of the obtained evidences.

Globally, lecturers identified as having opposite PTA seem to have distinct intentions when interacting with students through questions, being those intentions closely intricate to their teaching and learning conceptions. The two teachers identified as having an ITTF approach, indicating that they conceptualize teaching as 'transmission of information', described questions mainly as an instrument *for* and *of* the teacher. On the other hand, lecturers identified as having an CCSF approach, tended to focus their reflection on the fact that questions, whether it is a teacher question or a student

question, constitute a *joint* instrument to explore concepts, and that during this process it is possible to develop students' awareness about their own reasoning abilities. This type of questions 'functionality' is strongly related with the learning concept 'developing and changing personal meaning'. Drawing on this outputs, we argue that questioning intentions can be conceptualized in two broad, and opposite 'typologies': [0]*Product oriented questioning focused on teachers' benefits* and *Process oriented questioning focused on conceptual sharing* between teacher and students.

It is believed that the present study deepens the understanding of the relationship between Trigwell and co-workers PTA (Trigwell & Prosser, 2004) and questioning practices in higher education. Besides extending the Preferential Teaching Approaches conceptual framework, and teaching and learning conceptions, the identification of two distinct *questioning intentions* might also be useful for the design of effective professional development strategies.

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