The argumentative design principles of three courses in a Physics undergraduate teacher education program

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Abstract. To assure that current science education practices are aligned with recent educational research findings, there must be a constant effort of investigating the environments in which teachers are educated and prepared for their pedagogical action. One of the epistemic practices that should be discussed and taught in every teacher education program is argumentation. Preparing future teachers to construct and evaluate arguments and enabling them to design activities that scaffold students’ argumentative skills has become a highly desirable goal in science education in the past few decades. Despite that, few studies have been devoted to studying the role of argumentation and argumentative development in initial and continuing teacher education. The present study was aimed at observing and analyzing some of the characteristics of three courses of an undergraduate Physics teacher education program at a public university in the State of São Paulo (Brazil), and to compare them in terms of their potential contributions to the development or argumentation skills of its students. Preliminary results suggest that the curricular reform that has been implemented was responsible for shifting practices to a much more updated and theory-informed model, but the program’s focus is still on written instruction, and not on the development of oral communication skills, which would be key for a fertile argumentative development.

1. Introduction

Over the last few decades, there has been an intense growth in the number of academic studies and governmental reform proposals that advocate for important changes in the type of science education that has been offered to children and teenagers all over the world. The central claim of such reforms is that instead of focusing only on the quantity and depth of scientific content that is taught, it is necessary to create a balance between the teaching of scientific content, the development of students enculturation to scientific epistemic practices, and the promotion of scientific literacy goals, something that encompasses the social and environmental impacts of sciences and the way in which individuals deal with their choices when it comes to socioscientific issues [1].

Nevertheless, in order to make that science education practices with such characteristics may become a reality in all educational levels, there must be a constant effort of investigating the social environments in which teachers are educated and prepared for their pedagogical action. Similarly to young students, pre-service teachers are largely a product of a certain curricular design during their undergraduate studies and of all the didactic experiences that have been made available to them during that time [2]. If the envisioned goals for the 21st century’s science education include preparing citizens to be capable of recognizing scientific evidence and using it to formulate well justified arguments, these goals must be equally synchronized with solid and diverse practices in their teacher education and professional development programs by departments of education all over the world [3].

Possibly, two of the most challenging aspects of designing a successful teacher education program are:

1) organizing the experiences that teachers will have in well-chosen courses, so that they will be prone to integrate the subject-specific knowledge with adaptive skills, allowing them to choose one approach over another when that seems appropriate; and

2) to foment a desire to keep learning and investigating the perks and problems of their everyday practice.
When talking specifically about the learning experiences of teachers of scientific subjects, national educational reforms in many countries have suggested that 21st century science education should provide students of all ages and social conditions with lessons that combine the teaching of core scientific content, the discussion and comprehension of social, historical, ethical, and moral aspects of sciences, and also the apprenticeship of central epistemic practices for the making of science [1]. One of these epistemic practices that represents the dialogic and transitory nature of science and that defines science as an everlasting effort to know more and know better is argumentation [4].

Preparing future teachers to construct and evaluate arguments and enabling them to design learning environments and activities that scaffold students’ argumentative skills has become a highly desirable goal in science education in the past few decades. From a cognitive and psychological viewpoint, the same semiotic-dialogic mechanism that represents argumentation (supporting a claim with reasons, considering objections and responding to opposition) allows arguing individuals to shift their attention from a specific situation or phenomenon to focus on the underlying principles or justifications that sustain their claims, which is a very important higher order metacognitive skill to be developed by students [5]. Additionally, when thinking about the intertwined relation between teachers’ didactic strategies and students’ views on the nature of science, teaching argumentation in classroom is one of the strategies that allows pre-service teachers to comprehend how much the rational and social parameters used to validate scientific theories and models have changed across centuries, and also to realize that for certain controversial topics for which there are still not enough data to judge from (e.g.: human consumption of GMOs) or for which the same set of data leads to completely divergent explanatory models (e.g.: the origin of the observable universe), scientists are unable to come to a complete agreement, and those topics are under constant scrutiny and discussion among the members of the scientific community [6].

Despite having solid evidence about the benefits of incorporating argumentative practices in science education, until recently, few studies have been devoted to studying the role of argumentation and argumentative development in initial and continuing teacher education [7], [8], perhaps because argumentation has only recently become a widespread educational learning goal [8]. In this sense, the main goal of the present study was to observe and analyze some of the characteristics of three courses of an undergraduate Physics teacher education (TE) program of a public university in Sao Paulo state, Brazil, and to compare them in terms of their potential contributions to the development or argumentation skills of its students. In addition, the study also proposed to develop three argumentative practices for each of the subjects and to investigate how such activities would be received in these spaces and what effects they could have on professors’ perceptions of their own role when faced with innovations in higher education classroom practices.

2. Theoretical Background

In the research area of argumentation in science education, there is a relevant distinction to be made between the terms argument and argumentation. There is a theoretical perspective that suggests that we should use “the term argument for the product, the statement or result of reasoned discourse, and use argumentation for the argumentative discourse, for the social dialogic process” [7]. Although there exists such a theoretical distinction, the teaching of argumentation should give equal importance to both elements, since they can be treated as complementary aspects of the same phenomenon [8]. Thus, if teachers are expected to learn how to argue and how to include argumentation in their lesson plans, there must be equal attention to explicit teaching of argumentation (the one that deals mostly with the product, with the definition of arguments, with the difference between formal and informal logic, with the presentation of the main theories of argumentation, and the explanation of the main components of an argument and their functions in discourse) and the implicit teaching of argumentation (the one that is mostly related to the process, the design of the learning environment and the stimuli that the environment can provide for students to formulate ideas
based on empirical or theoretical data and expose those ideas for constructive criticism and dialogical learning) [8].

Regarding the second approach to teaching argumentation in initial teacher education, Jiménez-Aleixandre [9] synthesized six design principles that can be used to characterize learning spaces in terms of their learning goals, classroom activities, and teaching strategies, and that make them more or less prone to foster discussion and promote the development of argumentative skills by its participants. These characteristics listed by the author are: teacher’s role, students’ role, curriculum, assessment, communication, and metacognition. For an environment to be considered appropriate to promote argumentative skills, it is necessary that: (i) teachers are able to support and foster the development of an epistemological understanding; ii) students become active producers of justified knowledge claims and effective critics of other people's claims; iii) the curriculum is structured around solving authentic problems that it can generate a wide range of outcomes; iv) the assessment authority and criteria are shared by students and teachers, and it is done through a portfolio style and different instances of a communicative repertoire; v) students are engaged in reflections on their own knowledge and their own thinking and learning processes; and vi) communication takes place in an interactive and dialogic manner, with contributions from various participants and space for criticism and reflection, establishing a community of discourse.

Besides designing an environment that is appropriate to encourage and empower future teachers to incorporate argumentation in their lessons, Zohar [8] also points out that a big part of this process does not come as an automatic behavior but as the requirement of a clear goal, intensive thinking, and a high-level of self-awareness. To promote such level of self-awareness in future teachers, it is important that the new educational reforms that are slowly translated into undergraduate programs and finally individual courses are aligned with such commitments and that these spaces become embedded with the design principles initially idealized for the curriculum and with daily practices that require this level of self-awareness and communicative skills from its students. This is what is expected from teacher education programs that aim at developing their pre-service teachers’ argumentative skills and this is what has been investigated during this study: to what extent has an undergraduate teacher education program has been impacted by recent educational reforms and how aligned it currently is with design principles that advocate for teaching argumentation in initial teacher education.

3. Methodology of our case study: three courses of a teacher education undergraduate program

As previously mentioned, the central goal of this study was to investigate to what extent the learning goals, classroom activities, and teaching strategies of three courses of a 4-year-long undergraduate Physics TE program could contribute to the development of argumentation skills by its students. The present study is part of a more complete case study carried out during a doctoral dissertation. The specific goals of this study are aligned with the general goals of the more general case study, which aim at understanding the argumentative design principles [11] of several courses and elaborating a descriptive and explanatory framework for the potential contributions that this undergraduate program offers for the development of argumentation skills.

As a relevant piece of background information, before its last curricular reform, which took place between 2007 and 2009 [12], this TE program was designed in a way that did not put pre-service teachers in contact with instructional design or classroom practices before their last academic year. That formative model has been gradually overcome and the program is now in a new phase, in which its curriculum is structured around three main pillars or areas: Subject-Content knowledge (SCK) courses focused on Physics, Mathematics, and Chemistry (Pillar 1 - Red); Pedagogical-Content knowledge (PCK) courses for Physics teachers (Pillar 2 - Blue), and courses focused on historical, social, environmental, and technological aspects of sciences (STSE) and their implications for Physics teaching (Pillar 3 - Green) (figure 1).
In order to obtain detailed information, the researcher attended all lessons of three undergraduate courses during one whole term, observing interactions between professors and students and also using such observations to plan for an argumentation practice that took place at the end of each course. The three courses that have been selected to integrate this study were: 1) Didactics of Science - DoS - (senior year, 7th term, 60 hours, 4 credits); 2) Philosophy of Science - PoS - (junior year, 6th term, 60 hours, 4 credits); 3) Lab Physics 1 - LP1 - (freshman year, 1st term, 30 hours, 2 credits). These courses have been chosen due to the following reasons: i) they represent the knowledge diversity that is embedded in this TE program, for each of them belongs to a different area of knowledge and is lectured by professors with quite distinct educational, epistemological, and philosophical commitments. This aspect gave us some elements to compare whether or not argumentation is more likely to be fostered in Pedagogical-Content Knowledge (PCK)-related courses than Subject-Content Knowledge (SCK)-related courses; ii) each of these courses is taught at different stages of students’ learning trajectory in the program (LP1 is taught to very young high school graduates who have just got into university and who are being introduced to the program and to the new university life; PoS and DoS are taught when more than half of the students have dropped off the program and those that remain are very likely to graduate). This element allowed us to compare whether argumentation practices are more prone to be successfully implemented among older students that already have acquired more subject and pedagogical knowledge; iii) after contacting many professors, these were the ones that voluntarily accepted to be part of the study and to cede part of their classroom time for research purposes. After such discussion, the research question may be specified as: In the context of a well-established Physics TE program that has recently undergone two deep curricular reforms and that has been transitioning from a purely transmissional to a more practical formative model, what are some of the main contributions of three courses in that program to the development of argumentative skills by its students and how can these contributions be compared in terms of learning goals, classroom activities, and teaching strategies?

Data collection was designed in order to highlight key characteristics of those three aforementioned elements in each course: learning goals, classroom activities, and teaching strategies. In order to collect information about the courses learning goals, we have read the course syllabi available on the program’s
website and we have conducted two semi structured interviews with the professors responsible for each course, one in the beginning and one in the end of the term. Using two sources to gather data about the same element (e.g., the learning goals) was a strategy used to verify how well the individual perception of professors corresponded to the written goals that were described in the official documents. To obtain information about classroom activities, we used field notes that have been produced in-loco during lesson observations and also oral descriptions that professors did of their own lessons upon the researcher’s request. Finally, to comprehend the main teaching strategies used by professors when conducting those courses, we have used the researcher’s field notes and we have read some of the professors’ lesson plans.

Besides that, one argumentation practice related to specific content topics of each course was planned and carried out. The justification for doing so was that two main goals of the curricular reform that the program has been through are: 1) to shorten the gap between results of academic educational research and initial teacher education; and 2) to start a gradual transition from a very pragmatic content-based model of teacher education to a much more contextual and reflexive model of doing it. This curricular reform can be understood as a type of educational innovation. This type of educational innovation cannot be successfully implemented without some sort of collaborative mentoring, without which the core ideas of the new formative model would be easily abandoned. Therefore, these three argumentation practices have been designed and conducted to investigate how the faculty staff of three different departments would react when invited to incorporate new didactic strategies into their classroom settings and to which extent those practices would impact their perception about their own teaching roles.

Thus, we briefly describe hereafter the argumentation practices that have been developed in the three courses. In DoS, 12 students were split into small groups and asked to read and discuss two papers that described the main aspects of the 17th century debates between the particle and wave theories for light. Then, during the argumentation practice, they were asked to explain and justify daily optical phenomena (color, refraction, reflection, etc.) based on one of those models. We aimed at recreating the original controversies that existed in Optics in Europe at that time and see how students would formulate their arguments that had to be necessarily aligned with one of those two models for light. In PoS, 18 students were asked to read an excerpt from an article that discussed two interpretations for the relations between politics and science. After that, students were given 1h to debate on whether Physics major students should have courses related to political aspects of their jobs included in their undergraduate TE program or not and whether science should be involved in politics in some form. In LP1, an argument-driven inquiry laboratory practice that asked students to create a hypothesis for the mathematical expression that describes the propelling force of an air balloon when released in the air.

In the end of the term, professors were interviewed about their general impressions regarding the argumentation practices, such as the behavior of their students in that new type of classroom design, the nature of the debated topic, and the possibility of using an argumentation practice as an assessment strategy for their courses. The questions asked during the interviews were: 1) Could you please give me a general description of the course that you are teaching this semester? (Learning goals and general description); 2) What types of activities are planned during the semester so that students can acquire a good understanding of all the topics that are listed on the syllabus? (Classroom activities); 3) How would you describe a typical class in your course? (Teaching strategies). Data analysis was performed by organizing information about the learning goals, classroom activities, and teaching strategies from three different sources (course syllabus, professors’ interviews, and classroom observation) in one single table (Table 01). Based on this table, it is possible to visualize the main components of these three courses and compare them to the ideal conditions expressed by Jimenez-Aleixandre (2007) in her classroom-based framework.
4. Data analysis and discussion

Our initial hypothesis about the research question was that the contents of each course and the personal epistemologies and professional trajectories of each professor would result in completely different classroom environments, in the sense that we would possibly find an environment more prone to fostering argumentation in PoS when compared to LP1, since most topics and goals of the former are naturally geared towards debate activities about the bases of scientific knowledge. Besides, since we have investigated courses that had freshman students who had recently graduated from high school and also junior students who had already spent more than two years in their undergraduate studies, we expected to observe more discussion and higher oral communication skills among older students.

When reading the description of all the learning goals on the undergraduate program’s official website, it seems to be clear that all the courses express a concern for fostering students’ reflection (this word appeared many times in those documents). It is also possible to find specific terminology that reveals a commitment to incorporate educational research into classroom instructional design. The three courses analyzed expressed a strong concern about students’ reading, writing and interpretation skills. That is indeed a crucial aspect of any solid teacher initial education program: to scaffold students’ capability of reading and writing in different textual genres and form, and being able to extract and summarize relevant excerpts from those texts. Despite that, there are no mentions at all to the terms “argumentation”, “arguments”, “to argue”, and also very few mentions to the development of oral communication skills. It is relevant to discuss each one of the courses separately and see what are some of the connections between their learning goals, classroom activities, and teaching strategies, and how those connections create environments that are more or less appropriate for the development of argumentation skills.

Table 1. Learning goals, classroom activities, and learning strategies for the three courses analyzed.

| Didactics of Sciences - DoS | Philosophy of Science - PoS | Lab Physics 1 (Mechanics) - LP1 |
|---------------------------|-----------------------------|-------------------------------|
| **Learning Goals** (based on course syllabus) | 1) Understand Didactics as one of the dimensions of education and reflect on several educational paradigms; 2) Discuss the role of Physics teaching in the contemporary world and relations between Physics and Science teachers knowledge and practice; 3) Reflect on recent studies on Physics and Science Education; 4) Foster students development as readers of Physics Education research; 5) Analyse Physics lesson units for middle and high school and discuss how to adapt such lesson units to real classrooms; 6) Discuss different assessment strategies; 7) Reflect on values, norms, and meanings of social contexts that schools are part of. | 1) Discuss classical theories about knowledge and PoS; 2) Study the relations between theory and practice in Physics; 3) Debate the classical authors of the 20th century’s PoS; 4) Perform didactic transposition of such contents to help pre-service teachers enact them in classroom; 5) Practice reading and writing in different textual genres in Portuguese; 6) Study aspects of PoS that facilitate reflection on the social construction of scientific knowledge. | 1) Help students adapt to the academic environment, fostering their critical thinking; 2) Teach students how to identify, use and interpret data from scientific measurement instruments; 3) Improvement of students’ oral and written communication skills in technical and discursive language. 4) To perform and analyze basic Physics experiments, using concepts studied during theoretical and lab classes. |
| **Learning Goals** (based on professors’ interviews) | 1) “Students need to learn how to properly read a text and extract the most meaningful and relevant information from that text.” 2) “They must understand how to incorporate educational research results into their lesson plans.” | | |

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### Classroom Activities (based on course syllabus)

1. Dialogued lecturing about educational theory and classroom practice;
2. Text reading and interpretation practices;
3. Engage in group discussions about different topics in Didactics;
4. Work on individual written assignments;
5. Analyze Physics textbooks and other instructional materials.
6. Lesson planning exercises.

### Classroom Activities (based on professors’ interviews)

“We have theory-based lectures on topics of Didactics and then we discuss how those topics are related to Physics teaching and how they can be incorporated into their lesson plans and their classroom practices”

1. “All my classes are identical: theory-based lectures”;
2. I build my lecturing material based on classical texts”;
3. “My theoretical lectures assume student participation, but I have not seen much of that recently”

### Teaching Strategies (based on classroom observation)

1. Lecturing (PowerPoint Slides);
2. Read, interpret and summarize texts;
3. Group discussions;
4. Individual assignments;
5. Group Seminars;
6. Analysis of textbooks;
7. Lesson planning

### 4.1. DoS: learning goals, classroom activities, and teaching strategies

If there was only one course in which the topic of argumentation and the development of argumentation skills should be included, it should be this particular course, since argumentation is now recognized as a branch of research in Didactics of Sciences [5]. Therefore, not finding any explicit mentions to the word argumentation or any words that might be connected to that in the course’s learning goals leads us to believe that argumentation was probably not considered as an important topic during the 2007-2009’s curricular reform and it does not seem to be an integral part of this course’s practical repertoire. Nevertheless, from the three courses that have been analyzed, this was the one in which students were most engaged in meaningful oral discussions and in which they had more opportunities to disagree with their peers and to present evidence to back their claims. This was probably due to three specific factors: 1) the nature of the studied content, which always revolved around educational settings, personal experiences in schools and classrooms, and it ended up bringing memories that gave rise to comments, examples, analogies, and disagreements on those topics; 2) the professional experience of the professor responsible for this course, a person with vast experience in secondary education, in classroom management, in school management, in pedagogy and didactics, and in teacher initial and continued education.

### 4.2. PoS: learning goals, classroom activities, and teaching strategies

One of the main learning goals expressed in the syllabus of the course Philosophy of Science (PoS) and in the professor’s interview was to debate ideas and concepts contained in classical 20th century texts selected by the professor and to question the bases for knowledge. In fact, one of the goals explicitly expressed that has a direct implication for the development of argumentation skills is goal n.06 (course syllabus): “To study aspects of PoS that facilitate reflection on the social construction of scientific knowledge”. Nevertheless, it
was possible to notice that there was a strong gap between the learning goals of the course and its classroom strategies.

While the professor declared that his main goal was to create an environment in which students felt comfortable to share ideas and discuss the bases of their knowledge, classroom observation evidenced that his main teaching strategy was to lecture students and to complete the content that had been previously planned, not leaving much time for discussions and debate in the classroom. Besides, in his final interview the professor recognized that he had an “obsession” for completing the syllabus topics and when classroom discussions were opened to students, it became very hard to maintain control of the discussion topic and the time that was spent in that type of activity.

4.3. LP1: learning goals, classroom activities, and teaching strategies

This course was the only one that seems to have expressed explicit commitments in terms of learning goals directed to the development of oral communication skills (goal n.03 - course syllabus). Despite that, the course did not contain any classroom practices or instruments designed to monitor students’ interaction with the experimental settings and that could allow them to gradually improve their oral communication skills. Based on the researcher classroom observations, every class was based on an experimental guide that covered the main principles, laws or experimental values that should be determined and checked with theoretical values. This guide was highly scripted with sequenced and well-delimited steps, not allowing students to pose their own hypotheses and questions or changing the experimental setup according to their questions. Besides, every class was limited to two hours in total, time that was only enough for students to understand the basic setting of each experiment and collect essential data to write their reports at home.

A common practice that was observed during those classes was that a group of five to six students would usually divide the whole experimental practice in small actions (take measurements, write down data, rearrange experimental setup after each measurement, talk to the professor, etc) and attribute each action to specific members of the group. Once a certain action had been attributed to a member of the group, it would hardly be changed during the semester. After students left the laboratory, each one of them would be responsible for organizing their own information and sending one section of the lab report to the group leader, who would format it and write its final version to be submitted to the professor. Therefore, due to the limited time in the laboratory, to the highly controlled nature of the experimental guide, and to the division of tasks that happened naturally among the members of every group, the group leaders were the only students who were actually engaged in producing a scientific text based on experimental evidence, while the other members were limited to technical procedures who did not require from them a high level of critical thinking.

Even though the professor was careful enough to walk around the classroom and talk to each group, asking if they understood the practice and if they needed any help, their talk was usually limited to asking procedural questions on how to deal with measurement tools or which equations to use to extract certain values. Students were usually not motivated to ask their own questions, to design their own experimental designs, to choose the control variables, or to select what data would be the most important one to help answer the proposed research question.

Therefore, even though LP1 was the only course that expressed explicit learning goals committed to develop students’ oral communication skills, there were neither classroom activities nor teaching strategies in place to monitor and scaffold that oral communication development. Students were not explicitly required to formulate and test their hypotheses, elaborate their own experimental designs, create solid explanations for the collected data. The classroom environment revolved around the rules expressed in the experimental guide and the maximum goal was to elaborate the lab report.
4.4. Professors interactions with a didactic innovation and their final interviews: comparing the courses

One key aspect that determined to which extent research about argumentation could be incorporated into each classroom during that one-term period was the way in which each professor interacted with the researcher. LP1 professor agreed to meet in her office for weekly sessions of collaborative planning for the argumentation practice. During that time, we studied educational research papers, we discussed the activity design and she asked me to explain what exactly I meant by “argumentation” and how we could help students develop that in LP1 classes. DoS professor interacted with me mostly by email during the whole planning process and welcomed me to her office once to discuss the general aspects of the argumentation activity. PoS professor suggested the topic for the argumentation practice during our initial interview, but was not really involved in the preparation for the debate.

LP1 professor has expressed that it was extremely hard watching her students struggling to design their own experimental setup in that inquiry-based lesson and decide which measurements to take without influencing their ideas with her own opinions: “I could notice that they were super engaged, but they were struggling and I wanted to help them solve it faster, but I noticed that I should let them think for themselves for a while.” As well described by [6], “[...] implementing argumentation practices in a traditional classroom involves much more than adopting a new curriculum because it requires a deep pedagogical change. [...] it implies shifting away from the role of the teacher as an authority figure providing right answers and moving towards the role of the teacher as a facilitator. As such, it implies a fundamental pedagogical shift”. By participating in the planning of the argumentation practice and by being closely involved in the work of her students during that practice, LP1 teacher seemed to understand the depth of that challenge and to acknowledge its need to foster argumentation in her classrooms.

PoS professor described the argumentation activity as something very productive and innovative, saying that the semicircular formation and the adoption of an open debate question to generate discussion will definitely inspire his future lesson plans in this course. He mentioned that he had never experienced something similar to that during his time as an undergraduate or graduate student. He also stated that while watching the debate, he realized that there are alternative activities that may be very effective in generating critical thinking and in promoting the development of oral communication skills, other than just lecturing, which was a mention that represents a new level of self-awareness of this professor about the role of a teacher in the classroom.

DoS professor noticed her students’ difficulties to interact and to express themselves during the argumentation practice and attributed that to the complexity of the debate topic and to the lack of appropriate questions to mediate students’ interaction with the activity that was prepared.

5. Conclusion

When it comes to comparing the three analyzed courses, it may be stated that the one that was farther from supporting students' argumentative development was PoS, something quite different from the expectations of our initial hypothesis. This may be understood due to the fact that despite having content topics specifically designed to discuss the epistemological bases of scientific knowledge, the classroom practices and teaching strategies of this course are not very diverse and are conducted in a very one-directional manner. Another course that was initially expected to raise many opportunities for argumentation and that proved to be quite the opposite of that was LP1. The course was the only one that revealed explicit written learning goals for the development of oral communication skills and its experimental nature could generate a fruitful environment to discuss the roles of evidence, measurement, accuracy, argument, explanation, and other important concepts in experimental Physics. Nonetheless, the fact that all the lab practices were conducted based on a very scripted experimental guide gave few chances for students’ creativity. Besides, due to her professional trajectory in the hard sciences, LP1’s professor had never heard about the idea of “argumentation” used to describe students’ justifications of their own knowledge claims. Finally, DoS was
the course that promoted the most opportunities for students’ argumentative development. The reasons for that are that because DoS’ professor has a good level of awareness about the importance of different forms of classroom discourse, she instigates her students to debate about many didactic and pedagogical controversies. Besides, this course had the highest amount of teaching strategies, which helped to generate a diverse environment with many opportunities for oral expression. However, the main goal of this course is still in developing students reading and writing skills.

In terms of the incorporation of argumentation practices to the TE program analyzed, when an educational innovation is implemented in a certain institution, such as the 2007-2009’s curricular reform in this undergraduate program, all the individuals involved in it must feel committed to ensure that the key principles and elements that represent this innovation are put into practice and not abandoned along the way. This program’s curricular reform has been responsible for shifting professors and students’ practices into a more updated and theory-informed formative model, creating better prepared teachers. Despite that, the program’s main focus is still centered on written instruction, and not on the development of oral communication skills, which would be key for the creation of a fertile argumentation development.

From the six principles of argumentation design that were mentioned here, it is sound to say even though they must be considered as an intertwined net, the role of the teacher definitely has a central role in shaping the relations between all the other elements. If teachers or professors themselves are not aware of what argumentation is or what would be necessary to conduct argumentation practices in the classroom, it is very unlikely that this will be one of the teaching strategies chosen by them to design their classes, for teachers/professors are likely to avoid anything that shifts away from their customary practice and anything that generates uncertainty and lack of control in classroom, which is something that argumentation does. This statement can be extended to pre-service teachers during their initial education, but also to university professors who have already defined their teaching style and who are exposed to educational reforms that require deep changes and adaptation.

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