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## The challenges of integrating the discussion of controversial issues in initial teacher training

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### Abstract

In the framework of the Bologna process, and with regard to pre-service teacher education, it is necessary to model student-centred learning experiences in order to promote the required competences for future professional practice and critical participation in society. Despite the potential of discussion in promoting several competences, this methodology does not always integrate the teaching practices. This case study sought to: a) understand the experiences and views of future teachers from a School of Education on the use of discussion in their past education; and b) investigate the impact of an educational experience centred on discussion. Data were collected through narratives, questionnaires, interviews and participant observation. The learning situations experienced through this study contributed to the development of citizens more aware of their role in society and allowed the promotion of skills indispensable for an Elementary Education teacher.

### Key words

Bologna process; initial teacher education; discussion; science education.

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## Retos de la integración de la discusión de cuestiones controvertidas en la formación inicial del profesorado

### Resumen

En el marco actual del proceso de Bolonia, y con respecto a la formación docente inicial, importa modelar experiencias pedagógicas centradas en el estudiante con el fin de promover las competencias a la futura práctica profesional y a una participación crítica en la sociedad. A pesar del potencial de la discusión en la promoción de competencias, esta metodología ni siempre integra las prácticas de los docentes. Este estudio de caso trató de conocer las experiencias y opiniones de futuros docentes en una Escuela Superior de Educación sobre el uso de la discusión en su formación e investigar el impacto de una experiencia educativa centrada en la discusión. Los datos fueron colectados a través de narrativas, cuestionarios, entrevista y observación participante. Las situaciones de enseñanza-aprendizaje vividas han contribuido a formar ciudadanos más conscientes de su role en la sociedad y permitido desarrollar competencias necesarias al perfil de un grado en Educación Básica.

### Palabras clave

Proceso de Bolonia; formación inicial docente; discusión; educación científica.

### Introduction

In the current context of Bologna, the traditional educational practices, teacher-centred, should lead to teaching and learning process which give the student an active role. (European Commission, 2009). Bologna focuses, therefore, on the student, in his choices regarding “contents, mode, rhythm and learning place” (p.13). Since then, all participants in the process have undergone a constant adjusting; both the organizational level and the pedagogical level (Ramos, et al. 2013). Thus, there are many challenges that have applied to the higher education institutions and their teachers. As highlighted by Ramos and collaborators (2013), these days, “Being a teacher in higher education” (p.116) requires more than mastering scientific knowledge to work with students, it is also important to worry about the whole learning environment to be provided in classes. Accompanying this process of reorganization of higher education and subordinated to the objectives that are expected to promote in the students attending this level of education, the course of the Degree in Basic Education integrates fundamental principles oriented to the formation of citizens with knowledge, reflexive and problem solving skills.

It is, therefore, our concern to train future educators and teachers with skills to intervene in a constantly changing society, namely, flexibility, communication skills and throughout life learning (Galvão, 2004; Law number 49/2005 of 30th of August) and, simultaneously, didactic skills for their future professional practice. In this paradigm of change, the implementation of active teaching methodologies in science curriculum is constituted as being essential, highlighting, among them, the discussion of controversial issues. Although many professionals recognize the didactic-pedagogic advantages of the discussion and their relevance to achieve broad social goals of democracy and solidarity in society (Parker

& Hess, 2001) cognitive and socio-affective skills of the students, it is not always integrated in the teachers' practices. The reasons often pointed to its non-inclusion in teaching practices are related to the existing adverse conditions in the school and social system, the reduced familiarity with the discussion (Hughes, 2000, Reis, 2001, 2004, 2008) and, the problems of lack of training in this area (Chikoko, Gilmour, Harber & Serf, 2011). It is a methodology that both teachers and students need to learn to use.

This study presents the work with students of the course of Basic Education of a Higher School of Education in order to know their previous experiences and opinions in relation to the discussion, and investigate the impact of an educational experience using the discussion of controversial issues in their professional and citizenship skills. It is also important to consider the relevance of this educative practice in the initial training of teachers, in order to confirm if the pedagogical experiences experienced by the future teachers may be considered as a valid pedagogic approach to be included in their professional practice.

### **The Bologna process and the initial training of teachers**

The challenge of qualification of future teachers requires on the part of Higher Education Institutions a quality education. Bologna confronts the system of Higher Education with deep change in teaching methods and processes that guided for years the practice in these cycles of study. The Higher Education Institutions should adopt a facilitating role in building the learning of their students, helping them to walk their learning pathways (European Commission, 2009). The students become the main responsible ones for their learning process, and the teachers should "facilitate and guide that learning" (Lourenço & Guedes, 2007, p.17). Teachers and students are no longer in different fields to take an interdependent relationship in the teaching-learning process. Ramos et al. (2013) also highlight that the learning should focus on what the student is able to make, involving both individual and collaborative work in order to develop soft skills such as autonomy and teamwork.

In order to increase the competitiveness of the higher education system, make the courses more comparable and, thus, achieve greater mobility of students and teachers, the process of Bologna has associated the objectives: a) quality of teaching and assessment; b) adoption of a system formed by two cycles of study; and c) a system of credits (Ponte, 2005; Silva, 2005). The implications of such reorganization in cycles of training, as it is the case of training of future teachers and educators, refers to a reflective exercise on what it is to be a teacher. As stated by Ponte (2005), "any teacher must have a multifaceted training", therefore multidisciplinary.

As it was already mentioned, one of the intentions of these policies in the higher education triggered by Bologna, lead us not only to the importance of knowledge but also the development of a different posture, a more critical and interventional one of the students in society.

Despite the many legal and guiding documents (Decree-Law number 43/2007 of 22nd of February, Law of Basis of Educative System - Law number 49/2005 of 30th of August), which seek to respond to the demands of Bologna and, therefore, to the demands of society, to provide students with an education that gives them skills to deal responsibly with the various problems of their daily life, there is a possibility of failure. It is not enough to change programmes or the existence of legislation so that the changes are effectively integrated in the teaching practices of teachers. As stated by Martins (2002), it is

fundamental that education professionals understand what is at stake so that they can induce the necessary methodological changes and be aware of the meaning of innovative proposals. We are certain that this new paradigmatic guidance should be accompanied by a redefinition of pedagogical activities, particularly, in terms of implementation, monitoring and assessment of the teaching and learning (Lourenço & Guedes, 2007).

### The discussion of controversial issues in science education

In an open and democratic society, the science education has relevance in the training of citizens who are able to participate actively and responsibly in the discussion or in the resolution of scientific-technological problems (Cachapuz, Praia & Jorge, 2004). The knowledge and the understanding of science and technology and its role in our daily life enables the individuals to get involved and understand the discussions about those themes, as well as social implications.

The discussion of controversial questions is a teaching methodology that enables to respond to the demands of Bologna and to the current society marked by constant changes. Therefore, this educational approach is constituted as a valid option for teachers to adopt them in their practices. The discussion enables the participants to develop responsible citizenship, enabling them to deal with problems that incorporate the scientific and technological dimensions. Several authors defend the exploration of controversial issues in the science teaching regarding the construction of knowledge about the contents, the history and the processes of Science and the understanding of interactions between Science, technology and society (Colucci-Gray, 2009; Grace, 2008; Legardez & Simonneaux, 2004; Linhares, 2013; Lundström, Ekborg & Ideland, 2012; Millar & Osborne, 1998; Monk & Dillon, 2000; Oulton, Day, Dillon, & Grace, 2004; Reis, 2003, 2004; Sadler & Zeidler, 2004, 2005; Van Rooy, 2004). The discussion is here understood as a particular form of group interaction in which its members come together to address an issue of common interest, something we need to understand, appreciate or decide (Dillon, 1994, 1995; Reis, 2004).

Dawson and Venville (2009) defend that as elements of society, we should make decisions about themes related to, for example, climate changes, and sources of energy and control of population and ethical questions are raised which complicate the process of decision-making. Colucci-Gray (2009) relates the complexity of these controversial questions with the complexity of the real world, emphasising the diversity of actors that are involved in issues such as local people, politicians, traders and institutions. An issue is controversial if there are different points of view as the answers get in groups in accordance with the interests of the group or of the more personal nature. (Oulton et al., 2004; Solomon, 1994).

Empiric studies developed in Portugal highlight that the teachers and students are favourable in terms of including the discussion of questions in classes. Some of the highlighted questions by both educative participants are related to: a) the understanding of the scientific, technological and social dimensions of relevant questions for the citizens' lives; b) the development of the ability of thinking and argumentation; c) the motivation of the students; d) decision-making; and e) the formulation of opinions and grounded critics (Hilário, 2009; Linhares, 2013; Reis, 2001, 2004, 2008). This type of educative experience is, thus, able to lead an evolution in the cognitive, communicational, social and democratic processes, opening a way to scientific alphabetization and a participative and democratic citizenship.

Despite the importance given to the activities of discussion, not every practice of the professionals includes them. Actually, the science teaching is still characterized by

transmissive models where the privileged learning leads to knowledge that is historically and socially out of context. (Costa, 2007; Dolan, Nichols & Zeidler, 2009; Millar & Osborne, 1998; Reis, 2004). Consequently, not all students have access to this type of educative experience. It is possible to highlight difficulties related to the educative system that, due to its extension of curriculums and the use of national exams centred in memorization, make the performance of discussion activities in diverse educative contexts difficult. Among the teachers, the complexity of the issues in discussion, the difficulties in the management of the curriculum and the lack of familiarity in relation to the theme and to the methodology in question, can also become strong barriers for the integration of the discussion in class. In the students, there are problems related to their lack of experience in this type of activities and consequently, the lack of interpersonal skills (Cowie & Rudduck, 1990; Dillon, 1994; Gall, 1985; Linhares, 2013; Reis, 2001, 2004, 2008; Reis & Galvão, 2008). All these barriers can be overcome but, for that, it is necessary changes that constitute challenges for all educative community. It is essential that the teachers and the students are familiar with this teaching methodology in order to overcome the difficulties that they are confronted with.

## Methodology

This study took the form of a case study as it is aimed to understand the complexity of a social reality (Yin, 2001). In this case, the reality of two classes of the degree in Basic Education, in order to meet the experiences and opinions regarding the use of the discussion in the formative course and investigate the impact of discussion activities of controversial issues (done in a subject of Environment) in the development of professional and citizenship skills. Thus, the investigation has two phases: a first one where they study the opinions of students about discussion activities experienced in their school career; a second one, in which the students have experienced and evaluated four discussions done under the subject of ADS. Four activities were designed and implemented: a) viewing and discussion of video documentaries about the global warming; b) role-playing on the construction of dams; c) construction and boosting of blogs about controversial environment problems; and d) chat about the production of energetic cultures for biofuels. All activities involved an individual work component, focused on research, reflection and writing of a report followed by a phase of work and discussion in a small group with the respective group reflection. In the end, all groups presented their conclusions and discussed the ideas in the large group (in class).

The approach of case studies is generally accompanied by the collection from multiple sources (Yin, 2001), enabling us to discover the features of the case and then, understand the phenomenon under study (Ponte, 1994). To that end, many procedures of data collection were combined: a) narratives produced by students on their conceptions and their previous experiences regarding the discussion activities in the educational context (referred to in the presentation of results as “Nar”); b) observation of discussion activities (referred as “Field notes” in the presentation of results); c) application of a questionnaire (referred as “QF”), in order to evaluate the promoted discussion activities; and d) performance of interviews with some of the participants (referred as “Ent”).

Participated 67 students attending the environment discipline, 64 of them were female and 3 were male. The 67 students who participated in the study belong to two classes functioning in a different regime, one at daytime and the other at post-labour regime. The daytime class was consisted of 43 students (referred in the presentation of results as “D”), 42 were female and only one was male. The class of post-labour regime consisted of 24

students (referred in the presentation of results as “PL”), of which 22 were female and only 2 were male.

The results were subjected to an analysis of content of categorical type (Bardin, 2009). It was also done a quantitative analysis that consists in calculating frequencies and percentages in order to know the relative importance of each dimension that are considered in the instruments of data collection.

### Presentation of the results - Previous perceptions of students in relation to discussion activities

According to the narratives done by the students, the potentials associated with the implementation of discussion activities in educational contexts are many, despite many of them have never participated in this type of activities:

*Personally I never participated in discussions on educational context, sometimes during the classes some issues arise and are debated with each other, but on a more serious level, I have never participated (...). (Nar, PL5)*

The most preferred potential is the development of skills. The references related to this category are distributed by several aspects: a) substantive knowledge (87,5%); b) reasoning (39,3%); c) attitudes (26,8%); and d) communication (12,5%). According to them, the exchange of ideas and opinions during the discussion enables a deeper understanding of the theme in study and, consequently, the acquisition and share of knowledge. During this interactive process it is still developed, the reasoning when there is defence of opinions in a grounded manner, using, for this, diverse arguments. This situation contributes, therefore, to the promotion of greater argumentation ability and critical thinking of students. The moral and social component is present in the narratives of students it is also a highly valued aspect. Interpersonal relationships that are established and group work seem to be sensitive issues for them. In his view, the participation in discussion activities can improve the respect for the opinion of the others, since interventions should be controlled and the rules respected. These ideas are evident in many texts written by the students:

*The possibility (...) to contribute to the increase of our knowledge is one the best advantages and stimuli that we can find (...). What I highlight as being the most positive, was the fact that we can all, in a way or another, explain and expose our opinions, it was a moment where without prejudice and shame to speak, we communicated and did an exchange of ideas and opinions with people that do not think exactly the same way as us. It is actually very important to know how to express ourselves, but it is even more important to know how to listen. It was an aspect that indirectly we ended up working. I found myself noticing that this is a good way to learn and to consolidate new knowledge. (Nar, D14)*

Actually, many of these potentials essentially related to the skills that the discussion activities can promote in the students, they had already been reported in several studies previously done in an educative context (Dolan et al., 2009; Hilário, 2009; Legardez & Simonneaux, 2004; Lundström et al., 2012; Sadler & Zeidler, 2004, 2005).

The main problems detected in discussion activities done before, are related, according to the participants, to students and to teachers' difficulties. Regarding the students, the main problems are: a) the lack of communication skills and team work skills (61,5%); and b) a poor knowledge of the theme (17,9%). The lack of communication skills and team work skills are reflected, in the opinion of the students, on issues related to the expression of ideas and the relationship's difficulty among the participants in the discussion. Alongside this

situation, the limited knowledge of the themes to be discussed by the students is considered problematic because it results in incapacity to support an opinion on the subject in discussion. What seems to concern the participants the most is the type of interaction that is established between the students during the discussion and the lack of experience in team work:

*The limitations of activities relate mainly to manage to work in group, which is sometimes complicated when there is no proper participation by a member of the group, creating discord between the various elements, or when the class becomes more confused, when the topic is being discussed. (Nar, PL4)*

The teacher is considered decisive in overcoming obstacles, particularly, through their ability to conceive, manage and evaluate this type of discussion activities (56,4%). Their performance will reflect on the created environment and on the type of interaction established between the participants.

In the opinion of these students, the teacher must master the subject, which means, they must be prepared in advance for its exploration. The complexity of the contents involved in the controversial questions combined with the lack of practice of the teachers, can be an obstacle to the success of these activities (Hughes, 2000).

In their narratives, the students enunciated many aspects related to the teacher, and with the care that they must have in the implementation of this activities:

*The limitations that can be found are related to the disorganization that can be created in class, but students must be taught the most correct way to act upon those situations. (...) The teacher should be a mediator and try to get everyone involved and tell their opinion. (Nar, D18)*

In order to understand the type of evaluation provided to the students regarding the discussion activities, it was required the integration of this topic in the narrative. The narratives' reading enabled to realize that the evaluation criteria in discussion activities in educational context were not always used. In some cases, the students highlighted that the criteria were absent (16,3%). It is important to verify the absence of evaluation and its non-explanation or discussion by the teachers can contribute to the depreciation of this type of activity. Hughes (2000) presents precisely this statement referring that in the absence of evaluation the students are less committed and, consequently, the results may not be as good as those that could be made if the discussion was evaluated:

*As far as I remember, the discussion activities did not have evaluation criteria, as it was more a way for us to transmit our opinions to each other and obtain more knowledge about that subject, than a way to be evaluated. (Nar, D22)*

The absence of evaluation can be explained by the difficulty of the teachers to evaluate the learning promoted by this type of activity and by the lack of didactic knowledge about how to do it.

### **Impact of the educative experience using discussion**

The evaluation of the educational experience experienced by the students in the ADS subject was carried out through a questionnaire of global evaluation of activities, field notes and interviews.

Globally, the obtained data in the questionnaire enabled us to assess that the promoted learning as a result of the participation of students in discussion activities were centred in

the development of citizenship and participation skills in relation to the social relevance of the studied themes. The indications related to the development of skills were diverse and focus: a) on reasoning; b) on attitudes; c) on substantive knowledge; d) on communication; and e) on didactic knowledge.

In reasoning's dimension, the students managed to develop a reflexion about the diverse themes when faced with opposite views. Thus, the discussion moments favour a more comprehensive thinking on the subject and, in some cases; they led to a change of opinion about the subject. The exchange of opinions allowed to consider other explanations and contributed to an improvement of the argumentation by the participants. Simultaneously, during this exchange of ideas (before which there is an improvement of the theme's knowledge in study through research and reflexions to be done), substantive knowledge was promoted. The set of activities allowed the construction of more knowledge and the development of their cultural knowledge about important themes. This same knowledge allows the students to be more aware of the current environmental problems and transfer that awareness to children who they will work with:

*All themes developed in this subject contributed to my personal, social and professional formation, because now I can address themes without constantly making mistakes, as it was the case of global warming (...), with the performance of these themes I feel more prepared to defend certain points of view, as in the case of the dunes, I have never thought about their disadvantages (...). But concluding, this subject was a gain in my course as a person and a future teacher. (QF, PL2)*

The interaction provided by discussions led the students to communicate. The oral and written communication ended up being developed and improved, as some students have mentioned: "ability to write texts" (Ent, D7); "I learnt to transmit my knowledge" (Ent, PL20) and feel capable of speaking and participating in the discussion" (Ent, PL26,11). It is interesting to notice that those moments of discussion seem to have contributed to overcome difficulties in oral and written expression in the more shy students.

This type of educative experience, using discussion, favoured the development of more controlled behaviours and helped the construction of democratic and citizenship values, expressed through a bigger respect for the others during discussions, by the attention given to the diverse interventions (listen to the other) and by a better control of their own intervention:

*PL21 – (...) I think during the discussions (...). I remember that there were one or two points that made me change a bit my opinion, not much but it always changes something. (...) Maybe the aspects that I had as acquired, maybe they were not grounded enough, and existing a lack of grounding we ended up accepting others who are more grounded and that for us makes more sense than what we have, so I think it was more like that. I had some knowledge, not total and facing the discussions that occurred between my colleagues, I ended up obtaining new knowledge that I thought it was important. (Ent, PL21, p. 3-4)*

From the communicational point of view, the discussion favoured the expression of ideas and the way they were transmitted, that means, the students gained more confidence and felt more secure as they were participating and getting familiar with the process. Thus, the communication was largely benefited and favoured. The difficulties related to the communication of ideas are generally associated, as well as literature about the subject suggests, with the shy people, that feel a bigger difficulty in intervene and express themselves in front of the others. This rise of confidence to intervene and participate in discussions seem to have occurred beyond the online approach, where this aspect is clearly



referred by certain authors, like Moore (1997), Moran (2005) and Veerman, Andriessen and Kanselaar (2000); according to these authors, those obstacles seem to be easily overcome by students when participating in electronic discussions. The present study enables to state that the attendance discussion, when well-structured and managed also enables the shy students to develop their communication skills in order to overcome their fears, gaining confidence by participating in more discussion activities:

*D8 – It marked me the fact that, for example, in debates, as I have told you before, as I did not feel secure talking to the others ...*

*ENT – To express yourself.*

*D8 – To express myself, because I always have the idea that what I am saying is not correct. (...). I automatically take this assumption, and then I stay quiet and, sometimes, when I speak, I speak to myself or very low. Sometimes I say something, I give another step forward and (...) I think that the debates helped me develop myself in that aspect as I felt I was not alone in the game, it was me who belonged to a group and I felt, if I do not say anything this will harm the other colleagues, I think it was ... (Ent, D8,p. 1-2)*

Some considerations of students pointed the promotion of the didactic knowledge about the use of the discussion in educative context. In this sense, they perspective the possibility to address this method with children from 5th and 6th grade, others still highlighted that the worked themes can be adapted to any school grade.

*PL16 – Exactly and that then you can apply them in our future life with our students and transmit them what the teacher has transmitted us, being able to do the work in a different way. (Ent, PL16, p. 3)*

*Professionally, I think the main learning is given in concepts and in strategies to be adopted, as these activities encourage students to work with commitment, and I think that they should be used by teachers immediately. (QF, D41)*

Many of the participants are aware of the influence they can exert regarding the destiny of our planet; namely, sensitize the children from early childhood, as they are our future. The observations explained coincide with the ideas of Castano (2008), Colucci-Gray (2009) and Dolan et al. (2009); according to these authors, these activities allow a better comprehension of the underlying social aspect of these themes. This social feeling causes, thus, a bigger environmental commitment to an action in favour of the environment.

## Discussion and conclusions

As concluded by Ramos et al. (2013), the changes implemented by Bologna process, although present in the official and curricular documents that guide teachers in higher education, are not always enough for the integration of active methodologies in teaching practice. Recognizing the need to a better knowledge about the discussion and advantages that may result from its adoption by the higher education teacher, particularly in the training of future teachers, we proceeded to the collection and analysis of information for a better understanding of this teaching reality.

According to the participants, these activities allow the development of knowledge, reasoning, attitudes and communication skills. The formative aspects from an intellectual and personal and social development are, thus, promoted, as recommended by the current curricular documents.

The references related to the limitations of this type of activities, are related to students and teachers. With regard to students, the ideas of “respect for the opinion of others” are object of analysis pointing, this dimension as one of the most sensitive issues for students. If, on one hand, the discussion activities are regarded as positive by contributing to the establishment of better relations, on the other hand, these activities can be problematic when the interactions are not controlled. Regarding the teacher the comments of students focus on the difficulties that this professional can have in the management, implementation and assessment of discussion. The practice of assessment doesn't seem to be deeply rooted in the habits of teachers who implement this type of activities.

The discussion experiences experienced ended up overcoming many of the limitations and problems identified by students in narratives (before experienced this educative practice). This overcoming can be explained, by the rigorous planning of all moments of discussion and the way they were conceived, managed and assessed.

From the point of view of training future teachers, it is believed that we contributed to the training of citizens who are more aware of their role in society. Actually, it is expected to have promoted what (1988) and Parker and Hess (2001) understand that the discussion promotes and, thus, all the developed path works as an aid to the construction of a democratic society, in which its citizens have knowledge about the nature of science, are aware of the importance of intellectual knowledge and social collaboration. As evoked by Sadler and Zeidler (2005), the continued exposure to decision-making situations about controversial questions gives students the opportunity to explore their principals and emotions related to science and its applications. Naturally, its approach can only allow a better reach of their role as participating citizens in democratic societies, where science and technology have a consistent intervention. Providing students with skills to solve problems that they find in daily life independently and responsibly is, still, one of the possible implications that it is expected to have been achieved with this study.

As one of the main factors with influence in the type of teaching provided by the students is related to the school practices experienced during the basic and superior training (Silva & Carvalho, 2009), It is important to think, in the specific case of Higher Education, that when enabling the contact with less common methods, as it is the case of discussion (among others), our students can do these approaches in their professional future.

On the other hand, and recalling some skills to be developed in students to the acquisition of the Degree in Basic education, it is possible to state that their participation in these activities contribute to the promotion of diverse skills, namely: a) the promotion of knowledge in the area of training - related to environmental education; b) argumentation skills of the future teachers during the discussion activities; c) the ability to collect, select and interpret the relevant information regarding the issues in discussion in order to obtain grounded solutions for the problems in study; d) the ability to communicate the information, ideas, problems and solutions among colleagues in the attendance discussions conducted; and e) the ability to learn throughout life, when recognize the need to be kept informed. The evaluated, implemented and built discussion activities meet what was recommended by Bologna for teachers training.

## References

- Bardin, Laurence (2009). *Análise de conteúdo*. Lisboa: Edições 70.
- Cachapuz, A., Praia, J., & Jorge, M. (2004). Da educação em ciência às orientações para o ensino das ciências: um repensar epistemológico. *Ciência & Educação*, v. 10, n. 3, p. 363-381.
- Castano, C. (2008). Socio-scientific discussions as a way to improve the comprehension of science and the understanding of the interrelation between species and the environment. *Research in Science Education*, v. 38, p. 565–587.
- Chikoko, V., Gilmour, J. D., Harber, C., & Serf, J. (2011). Teaching controversial issues and teacher education in England and South Africa. *Journal of Education for Teaching*, v. 37, n.1, p. 5–19.
- Colucci-Gray, L. (2009). Role-play as a tool for learning and participation in a post-normal science framework. In: Gray, Donald; Colucci-Gray, Laura; & Camino, Elena (Eds.). *Science, society and sustainability: education and empowerment for an uncertain world*. New York: Routledge Research Series in education.
- Costa, N. (2007). Um olhar sobre o ensino das ciências na escolaridade básica: o lugar da investigação em didática na promoção da sua qualidade. In: Miguéns, Manuel (Dir.). *Ciência e educação em ciências: Situação e perspectivas*. Lisboa: CNE – ME.
- Cowie, H., & Rudduck, J. (1990). Learning through discussion. In: Entwistle, Noel (Ed.). *Handbook of educational ideas and practices*. London: Routledge.
- Dawson, V., & Venville, G. J. (2009). High-school students' informal reasoning and argumentation about biotechnology: An indicator of scientific literacy? *International Journal of Science Education*, v. 31, n. 11, p. 1421-1445.
- Decreto-lei n.º 43/2007 de 22 de fevereiro. *Diário da República*, 1.ª série, n.º 38, 22 de fevereiro de 2007. Aprova o Regime Jurídico de Habilitação Profissional para a Docência na educação pré-escolar e nos ensinos básico e secundário. Ministério da Educação, Lisboa.
- Dillon, J. (1994). *Using discussion in classrooms*. London: Open University Press.
- Dillon, J. (1995). Discussion. In: Anderson, Lorin. W. (Ed.). *International encyclopedia of teaching and teacher education*. Oxford: Pergamon.
- Dolan, T., Nichols, B., & Zeidler, D. (2009). Using socioscientific issues in primary classrooms. *Journal of Elementary Science Education*, v. 21, n. 3, p. 1-12.
- European Commission (2009). *ECTS user's guide, Luxembourg: Office for official publications of the European Communities*. Luxembourg: Office for official publications of the European Communities.
- Gall, M.D. (1985). Discussion methods of teaching. In: Husen, Torsten, & Postlethwaite, T. Neville (Eds.). *The international encyclopedia of education: Research and studies*. Oxford: Pergamon.
- Galvão, C. (2004). Science for all – A competence based curriculum in Portugal. In: ME-DEB (Coord.), *Flexibility in curriculum citizenship and communication/Flexibilidade curricular, cidadania e comunicação*. Lisboa: ME, DEB (CLE e CLN).

- Grace, M. (2008). Developing high quality decision-making discussions about biological conservation in a normal classroom setting. *International Journal of Science Education*, v. 1, p. 1-20.
- Hilário, T. (2009). *A discussão de controvérsias sociocientíficas na promoção de competências de cidadania em alunos da disciplina de Biologia do 12.º ano*. Dissertação (Mestrado em Didática das Ciências) - Universidade de Lisboa, Departamento de Educação da Faculdade de Ciências, Lisboa.
- Hughes, G. (2000). Marginalization of socioscientific material in science–Technology–Society science curricula: some implications for gender inclusivity and curriculum reform. *Journal of Research in Science Teaching*, v. 37, n. 5, p. 426–440.
- Legardez, A., & Simonneaux, L. (2004). Les conditions de la discussion dans l'enseignement des questions socialement vives. In: Tozzi, Michel & Etienne, Richard (Eds.). *La discussion en éducation et en formation - un nouveau champ de recherches*. Paris: L'Harmattan.
- Lei n.º 49/2005 de 30 de agosto. *Diário da República*, N.º 166, - I Série A, 30 de agosto de 2005. Segunda alteração à Lei de Bases do Sistema Educativo e primeira alteração à Lei de Bases do Financiamento do Ensino Superior. Ministério da Educação, Lisboa.
- Linhares, E. (2013). *A discussão como metodologia de educação em ciências no ensino superior*. Tese (Doutorado em Didática das Ciências) - Universidade de Lisboa, Instituto de Educação, Lisboa.
- Lourenço, J. M., & Guedes, M. G.(Coord.) (2007). *Bolonha: ensino e aprendizagem por projeto*. Lisboa: Centro Atlântico.
- Lundström, M., Ekborg, M., Ideland, M. (2012). To vaccinate or not to vaccinate: how teenagers justified their decision. *Cultural Studies of Science Education*, v. 7, p. 193-221.
- Martins, I. (2002). Problemas e perspectivas sobre a integração CTS no sistema educativo português. *Revista eletrónica de Enseñanza de las Ciencias*, v. 1, n. 1, p. 1-13.
- Millar, R., & Osborne, J. (1998). *Beyond 2000: science education for the future*. The report of a seminar series funded by the Nuffield Foundation. Londres: King's College London.
- Monk, M., & Dillon, J. (2000). The nature of scientific knowledge. In: Millar, Robin; Leach, John & Osborne, Jonathan (Eds.). *Good practice in science teaching: what research has to say*. Buckingham: Open University Press.
- Moore, J. (1997). Teaching by discussion: dangers and opportunities. In: Enerson, Diane; Johnson, Neil; Milner, Susannah & Plank, Kathryn (Eds.). *The penn state teacher ii - learning to teach, teaching to learn*. Pennsylvania: University Park.
- Moran, J. M. (2005). A pedagogia e a didática da educação on-line. In: Silva, Ricardo Vidigal & Silva, Anabela Vidigal (Eds.). *Educação, aprendizagem e tecnologia - um paradigma para professores do século XXI*. Lisboa: Edições Sílabo.
- Oulton, C., Day, V., Dillon, J., & Grace, M. (2004). Controversial issues-teachers' attitudes and practices in the context of citizenship education. *Oxford Review of Education*, v. 30, n. 4, p. 489-507.
- Parker, W., & Hess, D. (2001). Teaching with and for discussion. *Teaching and Teacher Education*, v. 17, p. 273-289.

- Ponte, J. P. (1994). O estudo de caso na investigação em educação matemática. *Quadrante*, v. 3, n. 1, p. 3-18.
- Ponte, J. P. (2005). O Processo de Bolonha e a Formação inicial de professores em Portugal. In: Serralheiro, José Paulo (Org.). *O Processo de Bolonha e a Formação dos Educadores e Professores Portugueses*. Porto: Profedições.
- Ramos, A., Delgado, F., Afonso, P., Cruchinho, A., Pereira, P., Sapeta, P., & Ramos, G. (2013). Implementação de novas práticas pedagógicas no Ensino Superior. *Revista Portuguesa de Educação*, v. 26, n. 1, p. 115-141.
- Reis, P. (2001). O ensino das ciências através da discussão de controvérsias: realidade ou ficção? In: Silva, Bento D. & Almeida, Leandro S. (Org.). *Atas do VI Congresso Galaico-Português de Psicopedagogia*. Braga: Centro de Estudos em Educação e Psicologia da Universidade do Minho.
- Reis, P. (2003). Os professores e a controvérsia em ciências. In: Neto, António; Nico, José; Chouriço, João Carlos; Costa, Paulo & Mendes, Paulo (Eds.). *Didáticas e metodologias da educação: percursos e desafios*. Évora: Universidade de Évora, Departamento de Pedagogia e Educação.
- Reis, P. (2004). *Controvérsias sócio-científicas: discutir ou não discutir? Percursos de aprendizagem na disciplina de ciências da terra e da vida*. Tese (Doutorado em Didática das Ciências) - Universidade de Lisboa, Departamento de Educação da Faculdade de Ciências, Lisboa.
- Reis, P. (2008). *A escola e as controvérsias sociocientíficas – Perspetivas de alunos e professores*. Lisboa: Escolar Editora.
- Reis, P., & Galvão, C. (2008). Os professores de ciências naturais e a discussão de controvérsias sociocientíficas: dois casos distintos. *Revista Electrónica de Enseñanza de las Ciencias*, v. 7, n. 3, p. 746-772.
- Sadler, T., & Zeidler, D. (2004). The morality of socioscientific issues: construal and resolution of genetic engineering dilemmas. *Science Education*, v. 88, p. 4-27.
- Sadler, T., & Zeidler, D. (2005). Patterns of informal reasoning in the context of socioscientific decision making. *Journal of Research in Science Teaching*, v. 42, n. 1, p. 112-138.
- Silva, A. S. (2005). Universidade à Bolonhesa ou Cozido à Portuguesa. In: Serralheiro, João Paulo (Org.). *O Processo de Bolonha e a Formação dos Educadores e Professores Portugueses*. Porto: Profedições.
- Silva, L. F., & Carvalho, L. M. (2009). Professores de física em formação inicial: o ensino de física, a abordagem CTS e os temas controversos. *Investigações em Ensino de Ciências*, v. 14, n. 1, p. 135-148.
- Solomon, J. (1994). Groups discussions in the classroom. In: Levinson, Ralph (Ed.). *Teaching science*. London: Routledge.
- Van Rooy, W. (2004). Bringing controversial issues into science teaching. In: Venville, Grady & Dawson, Vaille (Eds.). *The art of teaching science*. Crows Nest: Allen&Unwin.
- Veerman, A., Andriessen, J., & Kanselaar, G. (2000). Learning through synchronous electronic discussion. *Computers & Education*, v. 34, p. 269-290.
- Yin, R. (2001). *Estudo de caso: planejamento e métodos*. 2.ª ed. Porto Alegre: Bookman (Brasil).

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