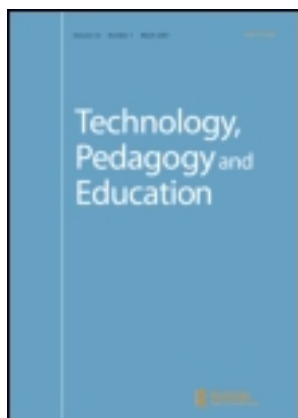


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L. Pombo <sup>a</sup>, M. Smith <sup>b</sup>, M. Abelha <sup>a</sup>, H. Caixinha <sup>c</sup> & N. Costa <sup>a</sup>

<sup>a</sup> Research Centre for Didactics and Technology in Teacher Education, University of Aveiro, Portugal

<sup>b</sup> School of Teaching, Health and Care, University Centre, Bradford College, UK

<sup>c</sup> Department of Communication and Art, University of Aveiro, Portugal

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## Evaluating an online e-module for Portuguese primary teachers: trainees' perceptions

L. Pombo<sup>a\*</sup>, M. Smith<sup>b</sup>, M. Abelha<sup>a</sup>, H. Caixinha<sup>c</sup> and N. Costa<sup>a</sup>

<sup>a</sup>Research Centre for Didactics and Technology in Teacher Education, University of Aveiro, Portugal; <sup>b</sup>School of Teaching, Health and Care, University Centre, Bradford College, UK; <sup>c</sup>Department of Communication and Art, University of Aveiro, Portugal

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The work reported in this article is part of a wider project that aims to develop and implement a web-based, pan-European, in-service professional development platform for teachers to enhance their role in promoting education through science. This article aims to evaluate the implementation of the e-module on Assessment of Children's Learning in Primary Science, which was created at Bradford College (UK) and was adapted to be trialled by Portuguese science teachers. The article (i) evaluates the e-module in order to find facilities and constraints with a view to improving it in future versions; (ii) analyses participants' opinions concerning strategies explored, resources and their reflections on their learning; and (iii) discusses the impact of the training on teachers' professional development. Data was collected through three different online questionnaires: (i) at the start; (ii) at the end of the e-module; and (iii) one year after implementation of the e-module. The results indicate that the majority of the teachers recognised that the module promoted the development of new skills during the course, such as ICT skills, which have an impact on classroom practice and enhance their professional development both in the personal domain and in the domain of practice. It was also recognised by both trainees and tutors that the main advantage of using an e-learning platform was that it enabled an adjustment to individual needs taking into account different learning styles and rhythms. They also recognised the importance of international dimensions of education; flexibility of timetables; and collaborative work between peers.

**Keywords:** evaluation; primary science; e-module

### Introduction

Many challenges face today's society, not least of which is the way that it changes so rapidly. Children find themselves in a society which is very different, not only from that of their parents, but from that of young people only a few years older than themselves. Ways need to be found that enable colleagues involved in teacher education to meet these challenges and provide support for serving teachers so they are the best equipped to provide their pupils with educational opportunities that relate to the world the pupils find themselves in. This article focuses on the evaluation of the continuous training and education of science teachers, where appropriate information and communication technologies (ICT) are used to provide serving

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\*Corresponding author. Email: lpombo@ua.pt

teachers with up-to-date training, as well as provide a structure through which they can share ideas and experiences within a European context.

The need for determining and maintaining quality in the process of designing, developing and delivering online learning materials is becoming an important issue for training institutions worldwide. Herrington, Herrington, Oliver, Stoney, and Willis (2001) have produced a number of quality guidelines that are based in three main areas: pedagogies, resources and delivery strategies. The pedagogies used in quality learning materials involve the following: pupils' achievement is evaluated using authentic tasks (tasks that reflect the way in which the knowledge will be used in real-life settings); opportunity for collaboration (pupils create products in a group that could not be produced individually); learner-centred environments (focus on pupil learning rather than teaching); and engaging (the learning environment and tasks challenge and motivate learners) and meaningful assessments (authentic and integrated assessment). The resources should provide accessibility (easily accessed and located); currency (the age of the resources should be appropriate to the subject); richness (variety of perspectives); purposeful use of the media; and inclusivity (materials should demonstrate social, cultural and gender inclusivity). The delivery strategies should be reliable and have a robust interface; have clear goals, directions and learning plans; should provide opportunities and encourage dialogue between pupils and between teachers and pupils. The materials should be accessible without lengthy delays; they should be accessible and available to all pupils; and finally, they should be appropriate to ensure a benchmark quality of presentation.

Online courses seem to be an increasingly convenient option for primary and secondary teachers to improve their own practice because it is possible to overcome geographic distances, ignoring the frontiers of space and time. The use of these quality guidelines is fundamental for determining and maintaining quality in these e-learning initiatives.

Underlying the Bologna Declaration are two fundamental concepts: 'lifelong learning' and 'mobility' – which are central to the policies of European higher education institutions (Carvalho, 2006). The creation of a European space implies an institutional transformation regarding the way curricula are conceived, making teachers and pupils responsible for the teaching/learning process (Coughlan, 2004), which will bring far-reaching implications for the evaluation of teaching in this context.

In Portugal, the educational and teacher education matrix is still managed generally by relatively conservative models (Carvalho, 2006). The institutions and forces that act are a strong barrier to the implementation of pedagogical innovation, as teaching is culturally determined by traditional patterns. Thanks to the Bologna Declaration there are signs of change in Portugal. One of the devices that can influence this transformation is e-learning (Carneiro, 2003). According to the Association for the Promotion and Development of the Information Society (2007), the integrated use of multimedia and the Internet to design and make available educational contents and to develop competencies at a distance is one of the biggest challenges for Portugal over the next few years. In our view, and considering the issues of teaching quality stated above, another area that should be discussed is the evaluation of teaching itself, as well as the quality of tools used for teaching and assessment.

The nature of the innovation underlying the teaching of science recently implemented in primary and secondary schools in Portugal, and the need to invest

in further training for teachers, will be enhanced by it being set within the context of a wider European dimension, taking into account the approaches of different countries when solving common problems.

ICT can improve the process of teaching and learning in several areas, including primary science. However, teachers should have competencies to decide how and when educational technological resources should be used in different educative contexts (Carrillo, 2008; Costa et al., 2008; Khan, 2008; Moreira, 2008). For instance, Webb (2005) concludes:

in order to make effective use of ICT-rich environments, teachers need to believe not only that affordances of these environments can support their students' learning but also that they themselves have a crucial role in planning and managing the learning experiences. (Webb, 2005, p. 733)

The development of innovative and motivating teaching and learning environments will depend on the investment in teacher training (initial and continuing) on the integration of ICT in various disciplinary areas (Khan, 2008; Miranda, 2007; Murphy, 2003; Peralta & Costa, 2007), particularly in Portuguese primary schools.

In the context of teachers' professional development, knowing how to use ICT means knowing how to integrate them into practices where students interact with peers and with the teacher, encouraging them to build their knowledge (Ramos, Costa, Gewerc, & Moreira, 2007). It is very important to enhance teachers' training so that the technical and pedagogical fields can be assumed to fall under their professional competence.

There are many advantages to applying new technologies within online courses but an overriding tenet is that the technology must never come between the learner and their learning. As Löfström, Kanerva, Tuuttila, Lehtinen, and Nevgi (2006) point out, a key aspect in the use of technology is that 'it is the educational solutions that guide the selection of technology and software, not the other way round' (Löfström et al., 2006, p. 37).

In this context, a European project was funded by the European Union designed to provide in-service training to science teachers in the primary sector (7–13 age range). The project, named 'SySTEM' (Systematic Professional Development through Science Teacher Education) (94343 CP-1-2001-1-PT-COMENIUS-C21/09), started in 2001 and was completed in 2005. This project provided the training materials necessary to deliver courses across Europe using traditional face-to-face techniques such as lectures and workshop sessions among nine universities from seven European countries: Bulgaria, Estonia, Poland, Portugal, United Kingdom (UK), the Czech Republic and Sweden. Each university was responsible for drafting various training modules for primary science teachers, and for their implementation and validation involving a group of about 20 teachers from each country.

Following completion of this project the rapid development in web-based technologies opened up avenues through which these resources could be exploited in a completely new and more effective way. There was a need to design a new project: 'EuSTD' (European Teachers' Professional Development for Science Teaching in a Web-based Environment) (129455-CP-1-2006-1-PT-COMENIUS-C21), which was funded by the European Union in 2006. This transformation to online delivery was crucial in order to face current and future learning needs, using a Virtual Learning Environment as a vehicle for the professional development of teachers, especially

when it is essential to share experiences from different European contexts. The Portuguese team was responsible for trialling the e-module 'An Introduction to the Assessment of Children's Learning in Primary Science', created in Bradford College (UK) involving Portuguese primary science teachers.

This article aims to: (i) evaluate this science teachers' e-module in order to improve it in future versions; (ii) analyse the participants' opinions concerning the e-module, strategies explored, resources and their reflections on their learning; and (iii) understand the impact of the training on teachers' professional development.

### **Description of the science teachers' e-module**

The module was completely rewritten as a blended learning course and was adapted to be trialled by Portuguese science teachers. The e-module ran over three months, with the first session being face to face and the other 10 online using the Moodle platform. The e-module was accredited by the Portuguese National Agency and involved three tutors of the Department of Didactics and Educational Technology of the University of Aveiro (Portugal) and one technical assistant. Twenty-two science teachers started the e-module with 18 successfully completing it.

The materials used during the e-module were available in English, although the communication between participants was in Portuguese. Other than the initial face-to-face session there were no synchronous sessions; each trainee or group had the opportunity to work at the platform according to their availability. The course structure did, however, include a series of deadlines which needed to be met and to which the teachers worked.

The main aims of the online module were that the students: (i) understood the difference between formative and summative assessment; (ii) understood the role assessment plays in the lesson planning cycle; (iii) became familiar with a range of assessment techniques; (iv) felt encouraged to use self-reflection as a way of improving their classroom practice.

The e-module was adapted for the Portuguese context with the number of sessions and tasks being reduced. This enabled it to be completed in about 50 hours over some three months. The training programme included an initial face-to-face session for presentation, another session for 'icebreaking' and 10 weekly sessions delivered through the VLE (see Table 1).

The face-to-face sessions were concerned with: (i) the presentation of the participants; (ii) the presentation of the European project; (iii) the assessment and the course contents; (iv) creating working groups; and (v) familiarity with Moodle. The remaining sessions occurred weekly at a distance, with constant discussions between all the participants. Tutors assisted the participants in all dimensions including the operation of Moodle, the English language, and any questions related to the contents.

The participants were assessed individually throughout the e-module by considering their active participation and interaction in the discussion forums and by the design of an individual e-portfolio to be delivered at the end of the e-module. The e-portfolio also included a final reflection, where participants evaluated the e-module's operation, their learning outcomes and the e-module's impact on their professional practices.

Table 1. Sessions, learning objectives and task schedule.

Sessions	Learning objectives
Face-to-face session (13 March)	<p>Presentation of the participants</p> <p>Presentation of the European Project in which the module is integrated</p> <p>Methodologies, assessment strategies and contents of the course</p> <p>Forming working groups</p> <p>How to use the platform Moodle (some technical aspects)</p>
Icebreaking session (online)	<p>Practice to work on Moodle</p> <p>To know better the participants</p>
Session 1 – An introduction to assessment	<p>Definition of key terms</p> <p>Understand the key differences between formative and summative assessment</p>
Session 2 – Looking at your own practice	<p>Identify an assessment tool in terms of the purpose of assessment</p> <p>Develop your own knowledge and understanding of assessment practices in other institutions</p>
Session 3 – Introducing different formative assessment strategies	<p>Develop your own knowledge and understanding of the use of questioning in the classroom</p> <p>Explore the value of questioning as a form of formative assessment</p>
Session 4 – Introducing different formative assessment strategies – listening to children	<p>Identify how to listen effectively to children and encourage them to talk</p> <p>Develop your own knowledge and understanding of how listening to children can be used as a formative assessment strategy</p> <p>Critically review journal articles and communicate key information to your peers</p>
Session 5 – Introducing different formative assessment strategies – assessing children's writing in science	<p>Develop your own knowledge and understanding of the assessment of children's scientific writing</p> <p>Further develop your knowledge of how this assessment tool supports the development of learning</p>
Session 6 – Introducing different formative assessment strategies – comparing a range of approaches	<p>Develop your own knowledge and understanding of a range of approaches to assessment</p> <p>Further develop your knowledge of how these different approaches support the development of learning</p>
Session 7 – Can children assess their own work?	<p>Develop your own knowledge and understanding of specific assessment strategies</p>
Session 8 – Debating assessment issues	<p>Explore a range of issues related to the assessment of children's learning in primary science</p> <p>Further expand knowledge and understanding of assessment with emphasis on the relationship between assessment and learning in primary science</p>

*(Continued)*

Table 1. (Continued)

Sessions	Learning objectives
Session 9 – Reflective evaluation of your own practice of assessment in primary science	Further develop the professional skills of evaluation and reflective practice Set personal targets for improving your own assessment of primary science
Session 10	Deadline for the individual portfolio

### *The e-module evaluation*

The evaluation of the e-module is aimed at improving the design and implementation of the e-module in future versions and sharing the main results with the other European partners.

The data collection tools were: (i) an initial questionnaire; (ii) a questionnaire on completion of the module; and (iii) a follow-up questionnaire applied to the participants one year after the implementation of the e-module.

The initial questionnaire (available at <http://wsl2.cemed.ua.pt/eustdweb/indexini.html>) (18 responses) aimed to establish an individual and professional profile of the teachers enrolled in the e-module, understand the assessment practices developed by them, and determine their training needs.

The end-of-module questionnaire (available at <http://wsl2.cemed.ua.pt/eustdweb/index.html>) (14 responses) aimed to provide data that could contribute to the improvement of the e-module implementation in future. The questionnaire focused on the structural aspects of the e-module and the contributions the e-module made in their professional practice.

The follow-up questionnaire (available at [http://spreadsheets.google.com/view-form?key=p9-13JK3JPtfMOB\\_Q6Rz5dA](http://spreadsheets.google.com/view-form?key=p9-13JK3JPtfMOB_Q6Rz5dA)) (17 responses) was designed to evaluate the impact the training had on the teachers' working practices. It was divided in four parts: (i) the impact of the e-module on their professional practice; (ii) the methods and assessment tools used before and after the e-module; (iii) to establish if methods learnt are disseminated after the e-module is completed; (iv) their suggestions on how the e-module could be improved.

The three questionnaires were applied online and were answered by the participants. The cohort was split into four groups with four or five participants in each. The collected data was treated using descriptive statistics.

### **Results**

The following results are organised according to the order in which the data was collected: initial questionnaire, end-of-module questionnaire, and follow-up questionnaire.

Regarding the profile of the participants, the cohort was made up of 15 females and 3 males; most of them (10) were between 31 and 40 years of age, five were between 41 and 50 years of age and, three were between 21 and 30 years of age.

Regarding the initial training of the participants, six are from mathematics and natural sciences, six from biology and geology, three from primary education and three from physics and chemistry. Regarding teaching experience, 14 participants have been teaching for over 10 years, two participants have been teaching for over

six years and two participants have been teaching for fewer than five years. Concerning the experience of the participants in the field of computer technology (Figure 1), all 18 participants said they use a computer daily, 17 said they use the Internet daily, 13 participants reported they had never had online teaching experience, and seven participants said they had already used Moodle.

The second part of the questionnaire included two dimensions: to understand the assessment practices developed by the teachers and to determine their training needs.

Regarding their professional practices (Figure 2), the use of pupils' self-evaluation to support their learning was mentioned by nine participants. Eight participants mentioned they always use a range of strategies and tools for assessment and use assessment as an integral part of the learning and teaching process.

Twelve participants said that they often use information about the assessment of pupils to plan and organise their classes and 11 participants said they often use formative assessment data to assess pupils' progress. Ten participants reported they always use pupils' self-assessment and 10 mentioned that sometimes they use written work by pupils in their assessment. However, four participants reported they had never used feedback as a way of improving pupils' learning.

Concerning the self-evaluation of training needs (Figure 3), the situations most commonly indicated by the participants were: the use of feedback as a way of improving pupils' learning (13 participants), the use of a range of strategies and tools for assessment (13), the use of learning assessment as a tool for reflecting on their own education (12) and the use of the assessment of practical activities implemented in the classroom (12).

After the online module was completed the participants were asked to rate, positively or negatively, aspects of the online course. The results of this are shown in Figure 4. Two areas stood out as an overwhelmingly positive experience: the collaborative work with other teachers and the self-reflection engendered by the course.

It was also clear from these findings that lack of time to complete the tasks and activities was a major issue.

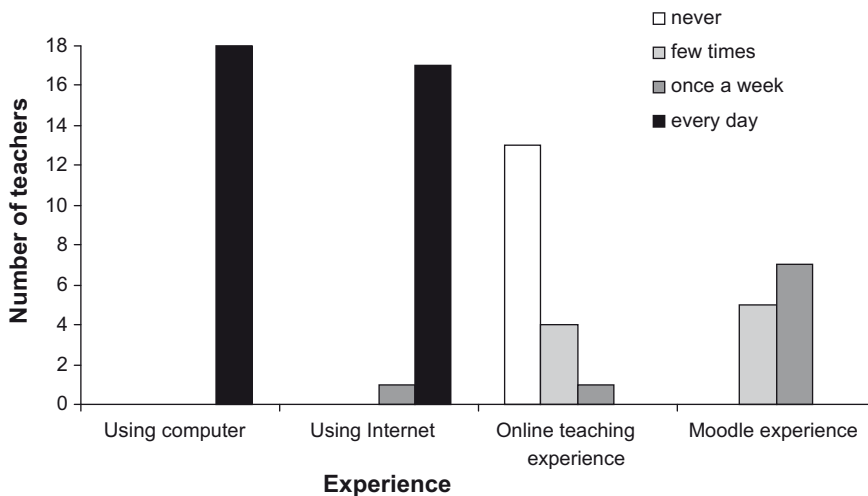


Figure 1. Experience of the participants in the field of computer technology.



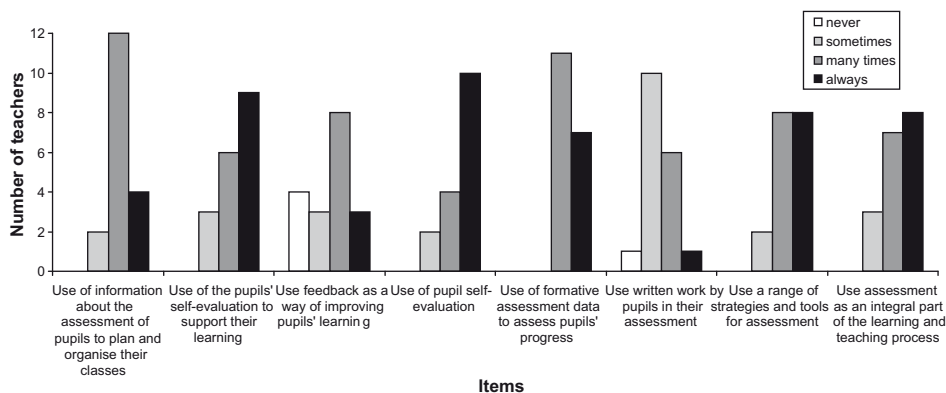


Figure 2. Participants' opinions about their professional practices.

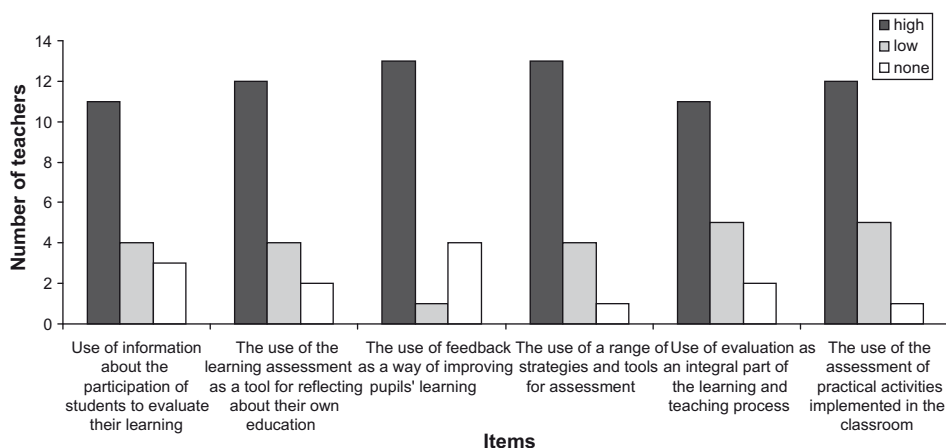


Figure 3. Participants' opinions concerning their training needs.

Regarding the nature of the tasks (Figure 5), most of the participants considered them 'professionally interesting' (11), 'appropriate' (8) and 'stimulating' (8) and five participants considered them easily understandable. The resources available to the participants were considered as 'appropriate' (11) and 'professionally interesting' (10).

Participation during the e-module was also assessed by using the number of posts made by each person, which varied from 22 to 134. Some of these posts (53) were considered to make a profound contribution to the online discussions.

With regard to the level of support provided by the trainers, all the participants considered they had all the support they needed, as is noted in the following statement: 'When I asked help from the trainer I used to have an immediate and enlightening answer.'

When participants were questioned about their views on the cooperation with other participants, the positive aspects were: friendship (2), collaboration (8) and sharing new ideas (2). As regards the less positive aspects, two participants said that

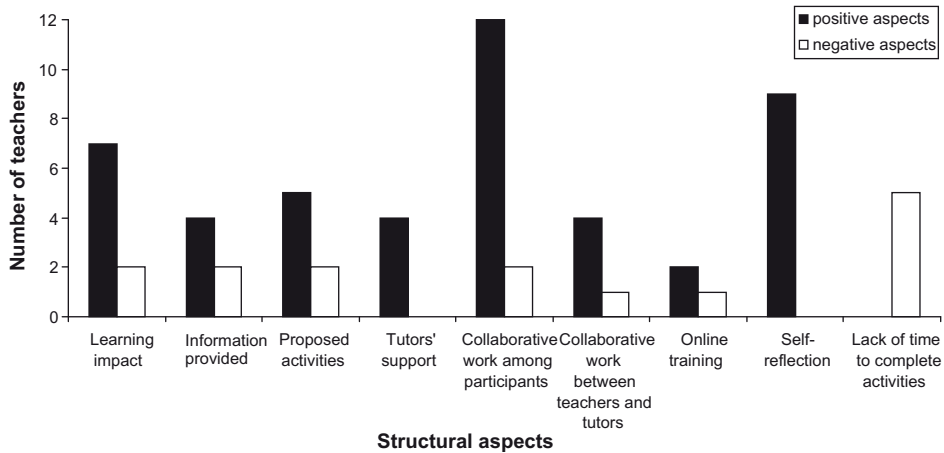


Figure 4. Positive and negative structural aspects of the e-module mentioned by the participants.

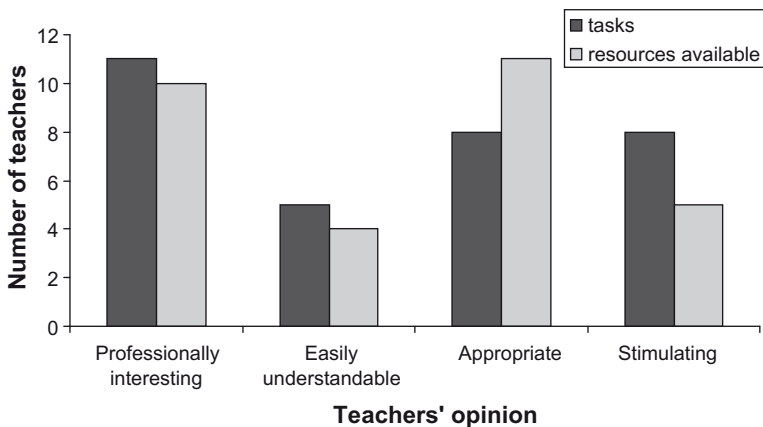


Figure 5. Participants' opinions about the tasks and the available resources of the e-module.

their 'professional and personal affairs limited the time available and affected the cooperation and support of this group'. Another aspect mentioned was the unequal contribution of the participants in some time periods, as noted in the statement: 'there was a collaborative work throughout all sessions, but not all group members have equally participated'.

The opinions of the teachers regarding the experience of this training in an online context, compared with the traditional methods of training, focused mainly on: the increased flexibility of hours (10); the development of new skills (6), in particular the use of new technologies and the development of reflective practice; the high level of training support (5) and the high degree of interaction between learners (5). It was also pointed out that conducting training in the European context was also a positive aspect as they had 'the opportunity to make training not only on the basis of

what is the reality of national teaching-learning, but with the level of what is known at a European level about teaching technology and education’.

Less positive aspects were the lack of knowledge of the work done by other groups (1) and the limited interpersonal relations (1).

Participants reported that the main advantages of the e-module were flexibility (9), collaborative work with colleagues (6), development of new skills (5) and sharing knowledge (4).

In contrast, they mentioned, as major disadvantages, limited interpersonal relations (6) and difficulties in managing the time for completing the tasks (4). As suggestions for improving the e-module, the participants referred to the possibility of increasing the time to complete the tasks (8) and increasing the weekly feedback from trainers (3).

Participants were asked how the online module contributed to their professional development. Figure 6 gives a breakdown of their responses.

Of the 14 participants who answered this questionnaire, 12 thought that the dimension of reflective practice was enhanced. It is interesting to note that the international dimension also figured highly in their development (10).

With respect to the influence of the e-module in participants’ professional practices, they highlighted the following aspects: a better understanding of formative assessment (6) and a greater weight given to self-assessment of pupils (4), resulting, in our view, from the discussion among the participants, and between participants and the trainers, during the e-module.

Finally, about the training itself, the teachers said it was important to continue to invest in online training, as the results show many advantages (4), they also had expressed interest in keeping the discussion forum alive (2), which sometimes in fact, happened.

The following results are concerned with the follow-up questionnaire (answered by 17 participants) that was designed to evaluate the impact that the training had on the teachers’ working practices.

Concerning the impact of the e-module on their professional practice, 14 participants mentioned that the e-module has a lot of influence, and only three mentioned

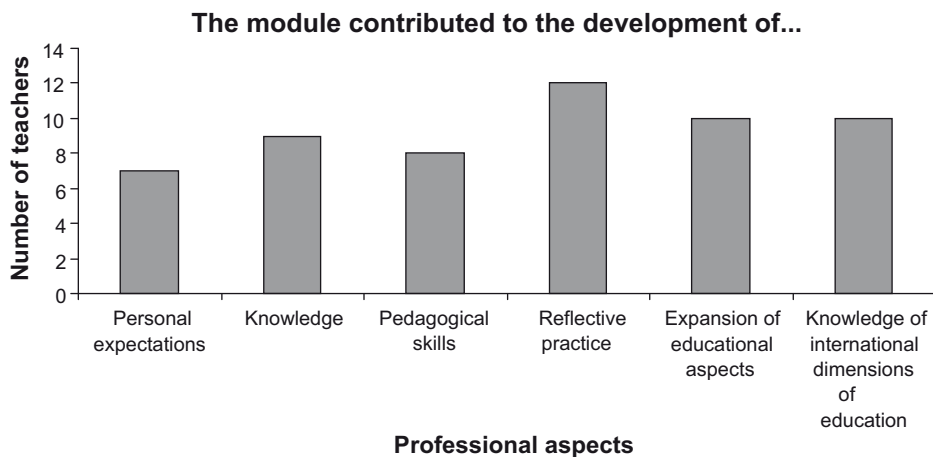


Figure 6. The e-module’s contributions to personal and professional development.

that the impact was much reduced. It is clear that those three who cited less impact on practice had low participation rates in the online activities.

The participants considered that they started to use a greater variety of assessment methods and tools (15); they are now capable of making a better diagnosis of their pupils' learning difficulties (14); they give now more importance to the self-assessment process of their pupils (14); and they start using the learning assessment of their pupils more often as a way to improve their teaching.

Concerning the frequency of the methods and assessment tools (Figure 7) used before and after the e-module, participants mentioned that they had started to use self-assessment of pupils more frequently (10), as well as peer assessment (9). Concerning teacher questioning, the funnelling technique and the technique 'listening to children', the majority mentioned that they now use these more often than they used to before undertaking the e-module (more than 9 participants).

Concerning the impact of the e-module on their colleagues at school, 12 teachers talked to their colleagues about the e-module, whereas five did not. From those who talked to their colleagues, they mentioned the need to focus more deeply on the continuous assessment of their pupils and not only on the final products; the diversity of methods and assessment tools that they can use in their schools; the importance of assessment to improve the teaching and learning process; the advantages of an online e-module; the importance of collaborative work; and the benefits of sharing learning resources and also opinions and ideas among teachers.

The participants were asked what changes could be introduced to improve the online course. The results are shown in Figure 8 below.

In order to improve the e-module in future versions, some suggestions were made by participants such as to have the other groups' work available (10); to increase the timetable for the tasks (8) and to make the support texts available in Portuguese.

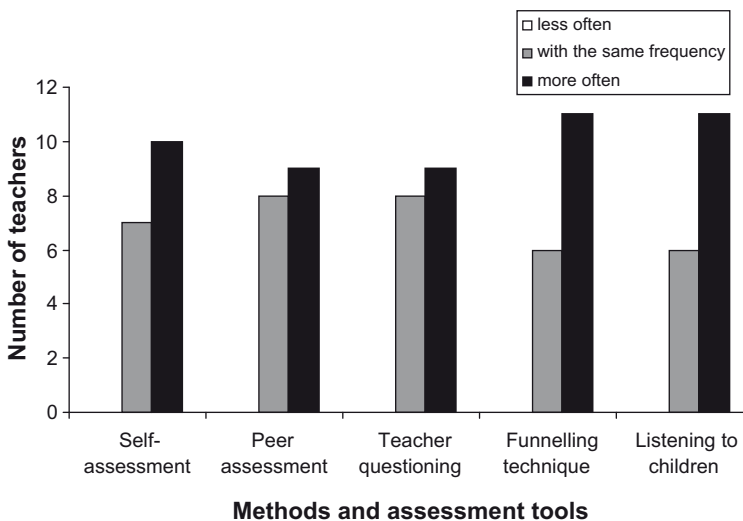


Figure 7. Frequency of use of the methods and assessment tools.

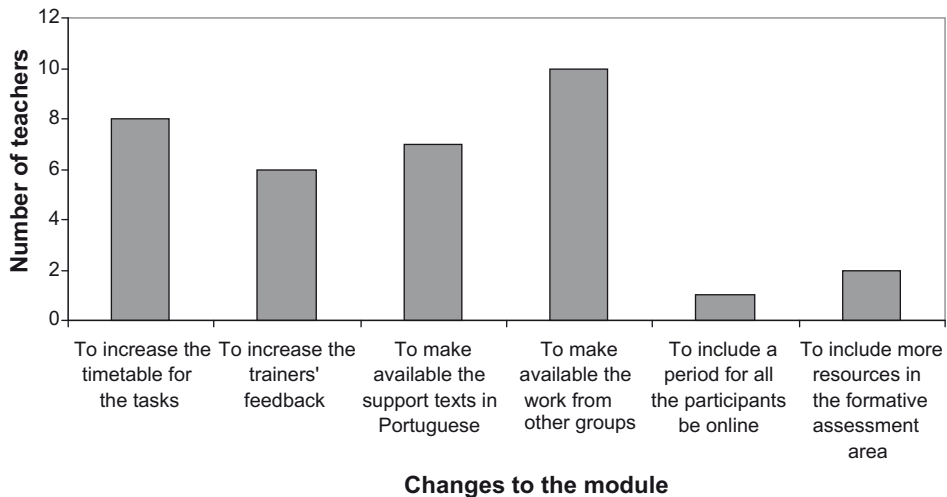


Figure 8. Changes suggested to improve the impact of the e-module on teachers' practices.

### Conclusions and final comments

The core of this article concerns the issue of promoting and delivering quality learning and teacher training. Considering that educators are continually updating their knowledge of their subject in order to effectively teach, they are responsive to a diverse range of students and teach a rich set of competencies in the content of a course (Mansvelt, Suddaby, O'Hara, & Gilbert, 2009).

This is clearly foreshadowed in the eLearning Advisory Group report, *Highways and Pathways* (Butterfield et al., 2002, p. 6), which stated: 'It is imperative that professional development is a priority throughout the tertiary sector so that academic staff have the abilities required for this new medium [e-learning].' Despite the fact the e-learning capability has been reviewed and assessed in a number of reports, little has been done to explore the impact of personal influences on professional development or what kinds of systems and structures might facilitate knowledge building and delivery of effective quality e-learning (Mansvelt et al., 2009). Furthermore, with the development of computer-mediated communication, education and training institutions began to adopt collaborative learning models in a virtual environment. The literature reveals how these virtual environments help teachers to share explicit and tacit knowledge, and examines the dynamics of the relationship between community members, and knowledge sharing and creation (Baran & Caglaty, 2010). In Portugal, Learning Management Systems (LMS) have already transcended the borders of universities and begun to establish themselves in basic and secondary education, both with open source and commercial LMS (Dias, 2008; Macário et al., 2010). The government's Technological Plan for Education (see <http://www.planotecnologico.pt/>) reinforces the need to create knowledge networks, incorporating learning spaces with professional practice, as well as the promotion of e-learning practices (Pombo, Loureiro, & Moreira, 2010). Thus, it is also important to reflect on the results of the implementation of these virtual training modules and learning communities in the professional development of teachers. In this study, it was recognised by the trainees that the development of new skills during the course, such as ICT skills, had an impact on classroom practice. It was also recognised by

both trainees and tutors that the main advantage of using an e-learning platform was to enable an adjustment to individual needs taking into account different learning styles and rhythms, as pointed out by Felder and Brent (2004).

Trainee feedback was also a fundamental component to feed the interactions and to reflect the commitment of both sets of participants (tutors and trainees). Various authors such as Coughlan (2004) and Keane and Labhrainn (2005) claim that a cycle of evaluation and improvement based on student feedback is a fundamental component of the process of quality improvement in higher education. Student feedback can be obtained through a structured group discussion and/or focus group but also by using a centralised questionnaire-based system whereby student feedback is collected and processed, as was the case in this study. Moreover, we believe that this kind of action needs constant feedback from trainers requiring them to be continuously active within the e-learning environment. Another advantage is the possibility to reach a broader audience, as participants are able to collaborate from various areas of the country, as well as sharing their educational experiences. In this particular case, the other main reasons for this success were the setting of training sessions in a European context and opening up the possibility of collaboration with colleagues from other countries. The initial face-to-face meeting was also crucial for icebreaking so that trainees start to share ideas and experiences throughout the e-module. Finally, we believe that it would be beneficial, in terms of interpersonal relationships, to increase the number of face-to-face sessions, perhaps by having, at least, other face-to-face session mid-programme.

In general, teachers considered as positive aspects the collaborative work and the fact that self-reflection was encouraged. The majority of the teachers found the nature of the tasks professionally interesting and stimulating, and the available resources appropriate. Participants did talk to their peers about the course with particular reference to the use of formative assessment to inform planning and its role in improving the teaching and learning process. The importance of collaborative work was also discussed. Regarding the less positive aspects, participants reported the time-consuming nature of some of the tasks, the lack of knowledge of the work of other groups since the work was completed within groups and not between groups; however, we are of the opinion that the work carried out intra-group can be shared and commented on by other groups in order to enrich the work and further share good practice. This is an aspect that the authors have been considering in other training programmes (Pombo, Loureiro, Balula, & Moreira, 2009).

From those results, and as key recommendations to consider for future work, we may suggest: (i) supporting trainees to work collaboratively; (ii) encouraging trainees to increase their self-reflection; (iii) increasing flexibility at the very beginning so that trainees feel comfortable with being part of the whole process, including choosing activities to increase motivation; (iv) increasing the interaction between groups; for example, to ask students to assess the work done by the other groups, using open asynchronous tools for that purpose (this way, students would gain a deeper knowledge of each other's work and could be more collaborative online); and finally, (v) increasing the number of face-to-face sessions to enhance the interpersonal relationships between trainers and trainees.

In summary, the choice of e-learning appears to be a very pertinent and practical method to support the concept of lifelong learning. During the last quarter of the last century, it became abundantly clear that the desired reform in science teaching and learning could not be accomplished without significant development of in-ser-

vice science teachers (Dass & Yager, 2009). This kind of e-training makes it possible to overcome geographic distances, surpassing the frontiers of space and time. The flexibility offered by this method was found by teachers to be a key advantage and one that enabled them to structure their learning around personal and professional responsibilities and commitments. Furthermore, the design of this training helped teachers to develop confidence and skills in the using ICT to impact directly on their teaching practices. It also elevated the quality of professional development in the personal domain (development of attitudes and knowledge) and in the domain of practice (professional experimentation), and subsequently the general understanding of how best to shape and implement teacher learning opportunities for the maximum benefit of both teachers and students.

### Notes on contributors

Lúcia Pombo is an Auxiliary Researcher of the Research Centre for Didactics and Technology in Teacher Education of the University of Aveiro (Portugal). She holds a PhD and a Masters degree in Biology; she concluded a post-doc project on the impact studies of post-graduation education of Science Teachers. Her research interests are related to evaluation of educative quality using ICT in online contexts and also on the assessment of students in higher education.

Until his recent retirement Malcolm Smith was a Senior Lecturer coordinating ICT throughout the Teacher Education courses at Bradford College in the UK. His research interests are centred on the pedagogies associated with online learning.

Marta Abelha is a lecturer at Portucalense University (Portugal) where she teaches the subjects of Didactics and Educational Projects. She holds a PhD in Didactics and a Master degree in Management Curriculum both concluded at the University of Aveiro.

Helder Caixinha is a lecturer at the Department of Communication and Arts in the University of Aveiro (Portugal). He was graduated in Electronics and Telecommunication Engineering, he holds a Master in Information Management and he is currently a PhD student in the area of Multimedia in Education. His main research interests are the use of ICT and Web 2.0 tools for the support of (both formal and informal) teaching, and Online Learning Communities within its physical and virtual ecosystems.

Nilza Costa is a Full Professor of the Department of Education of the University of Aveiro (Portugal). She belongs to the Research Centre for Didactics and Technology in Teacher Education, where she coordinates the Laboratory for the Evaluation of Educational Quality. She was the Coordinator of the Project “European Teachers Professional Development for Science Teaching in a Web-based Environment” (EuSTD-web) in the SOCRATES/Comenius 2.1 Program (ref.129455-CP-1-2006-1-PT- COMENIUS-C21).

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