



University teacher competencies in a virtual teaching/learning environment: Analysis of a teacher training experience

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ABSTRACT

This paper attempts to shed light on the competencies a university teacher must have in order to teach in virtual learning environments. A teacher training experience was designed by taking into account the methodological criteria established in line with previous theoretical principles. The main objective of our analysis was to identify the achievements and difficulties in a specific formative experience in order to assess the suitability of this conceptual-methodological framework for the design of training proposals aiming to develop teachers' competencies for virtual environments in higher education.

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1. Introduction

Analysing the changes in teachers' roles brought about in a virtual learning environment was the main focus of attention in various research work carried out over the past few years (i.e. Coppola, Hiltz, & Rotter, 2002; Goodyear, Spector, Steeples, & Tickner, 2001; Klein, Spector, Grabowski & De la Teja (2004); Egan & Akdere, 2005; Williams, 2003). All this research pointed out that teachers must rethink their teaching role in order to facilitate communicative situations suited to the peculiarities of various interrelations, i.e. between the teacher and their students, among students, and between the teacher, the students and the content – in a virtual environment based on asynchronous learning (Coppola et al. 2002).

Whilst all these studies make a distinction between teachers' functions, roles and competencies taking into account the peculiarities of virtual environments, they did not outline teachers' functions in these environments in a significant manner. Furthermore, they failed to clarify which competencies are associated to new or renewed teachers' functions. These studies were based on the systematisation of teachers' experience and were clearly circumscribed to specific university environments.

Making generalisations on the aforementioned conceptual basis is impossible. However, global changes affecting our universities today call for guidance and agreement on defining teachers' functions in virtual environments and their corresponding competencies. These conclusions should be kept in mind, particularly when thinking about teachers' need for training to cope effectively with educative changes.

Apart from the above mentioned conceptual problem, demands for changes in teachers' roles are not made explicit; and they frequently arise only in indirect ways, as pressure for implicit change in current curricular reforms does ("Implementation of Education & Training 2010 Work Programme", 2004, p. 34). On the other hand, progressing in clarifying the organisational, instructive and technological functions involved in teaching in this new educational paradigm is a necessity.

In addition to this vagueness, we also find a diversity of interpretations of the terms "teacher functions" and "competencies" (Anderson, Rourke, Garrison, & Archer, 2001; Eraut, 1998; Gonczi, Hager, & Athanasou, 1993; Goodyear, Spector, Steeples, & Tickner, 2001; Salmon, 2000; Westera, 2001).

Unfortunately, the concept of competency is used in several differing ways. In general, there are two clear approaches: one viewing competency as a personal skill or ability, linked to behaviour efficiency (McLellan, 1996; Pearson, 1980; Spencer & Spencer, 1993; cited in Eraut, 1998), and another approach which understands competency as strategic behaviour, linked to the possibility of adjusting performance to the demands from the

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context. The latter approach seems better suited to refer to teachers' competencies, whose exercise must unavoidably respond to the peculiarities of their given educative context. Accepting the social nature of competencies implies that it is the actor – and their expectations – who determine and shape the content of the competencies required to succeed in specific professional contexts (Gonczi et al., 1993; cited in Eraut, 199; Messick, 1984; Westera, 2001).

In view of this lack of precision, before progressing into teacher training, it seems necessary to delineate the competencies a university teacher should have in order to be able to teach in virtual learning environments, and also to set out the methodological criteria cited in the literature for the design of training activities. In the second place, and from the conceptual framework we are presenting, we will analyse a teacher training experience, which was designed taking into account the defined criteria, aiming at identifying the achievements and difficulties of a concrete experience, and with the ultimate purpose of assessing the suitability of the proposed framework for the design of formative proposals intended to contribute to the development of teachers' competencies for virtual environments.

2. University teacher competencies for teaching/learning in a virtual environment

The study we present is based on a socioconstructivist and situated approach, which means that the actions people perform and the context that surrounds these people are intertwined and, thus, they must be regarded as parts of a joint construction of totality (Hung & Der-Thang, 2001; Jonassen, 2003; Lave & Wenger, 1991). Broadly speaking, learning is considered a distributed interactive and contextualised process resulting from learners' participation in a community of practice. A community of practice is group of people who share certain values and cultural practices and a given organisation aimed to the achievement of goals.

The term competency has been subjected to multiple interpretations. For our research, we chose an operative concept, appropriating the definitions by Eraut (1998) and the Directorate for Education, Employment, Labour and Social Affairs Education Committee of the Organisation for Economic Co-operation and Development/DeSeCo (2005), which define a competency as a system of complex actions including the knowledge, abilities and attitudes required for the successful completion of tasks. This configuration as a whole can be summoned to act effectively on certain demands from social practice, that is to say, external social demands, capabilities, individual disposition and context are all part of the complex nature of competency.

While bearing in mind this approach to the notion of competency, we consulted other bibliographical materials that more clearly outline teachers' performances required in virtual learning environments (i.e. Bates & Poole, 2003; Campbell, 1998; Coppola, Hiltz, & Rotter, 2002; Jonassen, Peck, & Wilson, 1999; Laurillard, 2002; Moore & Anderson, 2003; Salmon, 2000; Trill, 2001; Westera, 2001; Williams, 2003).

In spite of sharing the notion that teachers' functions in virtual environments are in principle an extension and/or a transfer of the functions required to teach in a face-to-face context, we consider that a change in the nature of the environment calls for new competencies. Virtual teaching and learning requirements are not limited to a set of knowledge and experience. The challenges teachers face up are closely linked to the particularities of interacting and communicating online.

One of the pioneers dealing with this topic is Berge (1995), who emphasises that the demands made on communicative

competencies should be a priority. Berge refers to the online teacher's function as that of an instructor/facilitator and categorises teachers' roles into four areas: pedagogical, social, managerial and technical. He pays special attention to the specificities of ICT when making suggestions for every of these areas, which may help teachers during the teaching–learning process.

The definition of teachers' functions and roles specific to virtual teaching–learning environments is more recent. It results from observing and analysing the experiences of those teachers who in their daily practice respond to the challenge of teaching in virtual environments. It is, in general, informed by this classification into four main areas proposed by Berge.

Among the most recent literature reviewed for this study, the studies by Coppola, Hiltz, and Rotter (2002), Klein, Spector, Grabowski, and De la Teja (2004) and Williams (2003) stand out for their methodological rigour. Given the aims of our study, we will now proceed to comment on what we believe are the most relevant contributions made by these works to the matter in hand.

Williams (2003) defines four major dimensions to categorise university teachers' functions in environments introducing ICT: (1) communication and interaction; (2) Instruction and learning; (3) management and administration; and (4) use of technology (transversal to all). These functions are defined by the competencies they require in practice, which in this study are identified and classified by utilising the Delphi technique.

Coppola, Hiltz, and Rotter (2002) focus their attention on the changes perceived by teachers as required for teaching in virtual environments. The most significant aspect of this research is the importance it places on the teachers' views on their functions. It shows that teachers view the change as a transition from “subject expert” to “performance coach” in a learning situation. The changes are linked to the styles of interaction with students and with other teachers; changes in the instructional design, particularly in organisation, management, control/assessment of the teaching–learning situation. Taking these statements into account, three specific university teachers' roles are described for virtual environments: cognitive, affective and managerial.

Although not dealing exclusively with virtual teaching, the study published by the International Board of Standards for Training, Performance and Instruction (IBSTPI), cited here as Klein, Spector, Grabowski, and De la Teja (2004), is also worth mentioning. The list of competencies devised by IBSTPI includes 18 clusters referring to five domains of teachers' performance that can be linked to their functions: professional foundations, planning and preparation, instructional methods and strategies, assessment and evaluation, and management. In addition to detailing the competencies corresponding to each domain of performance, this study also describes 98 performance statements which allow for adequate representation of the competencies, both in terms of assessment and training. This study was validated globally with a sample of more than 1, 300 practitioners in all regions of the world.

Other researchers reviewed in this study were not aimed to clarify teachers' functions and competencies, but they do bring to the fore and argue that teachers in virtual environments should encourage creative thinking or the strategic and meaningful building of knowledge. They give thus great importance to the communicative function (Gunawardena & Zittle, 1997; Laurillard, 2002; Prestera & Moller, 2001; Salmon, 2000).

In all these cases, the functions outlined are associated to different roles, which, in turn, are defined by the more or less precise set of competencies teachers need to work in a virtual environment. A lack of agreement on what the roles are and how they are distributed can be explained by the fact that diverse roles

are shaped in relation to the tasks performed by teachers. These roles vary depending on the organisational and social specificities of every context.

After analysing the various studies cited above we can identify the following specifications for every teachers' functions/roles:

- (a) Design/planning function: planning in a virtual environment lies in the fact that this is not only an action undertaken prior to the start of the course, but also an action that requires a concerted effort for the successful completion of the virtual course. Organising and managing involve carrying out tasks to establish relationships between the teacher and other staff in terms of technological/educational coordination, between the teacher and students and among students themselves in order to achieve the learning goals of the course. Monitoring and follow-up actions determine the effectiveness of the communication between participants. In addition, they have an effect on motivations; and they relate to the evaluation of the learning process.
- (b) Social function: this function includes actions related to teachers' intervention to improve their relationship with their students and the relationships among students themselves during the teaching/learning process in a virtual environment. This function is particularly and distinctively important because it is difficult to achieve emotional expressions, i.e. non-verbal communication, which undoubtedly conditions the nature of the working environment. This barrier reinforces the need to find new tools and behavioural patterns, so that fluent and cordial communication is achieved during the knowledge building process in virtual environments.
- (c) Instructive function: this function relates to teacher's cognitive command, i.e. their expertise in their subject matter, and his/her competencies, which contribute to deep, complex and critical learning. Teachers need a solid knowledge of the field of distance learning and possessing abilities to present content and facilitate learning by means of technological tools and resources, an issue that is even more complicated in collaborative learning environments.
- (d) Technological domain: learning environments with ICT applications allow for the definition of a fourth command, which relates to the set of technological abilities required for the development of any of the functions described above. This refers to the knowledge of teacher support technological services, basic computer knowledge to be able to use the necessary technology and some specific knowledge about multimedia and useful educational software.
- (e) Management domain: this function, together with the competencies associated to it, enables the teacher to carry out planned actions and to adapt them: to meet learning expectations, motivations and needs; to handle the virtual classroom; to manage communication channels and spaces; in other words, to supervise and adjust the ongoing and virtual process.

It is worth highlighting that all the studies reviewed point out that the set of competencies required for the technical and managerial mastery of the teaching process in virtual environments is linked to all functions and roles. Emphasising the important role played by the teacher social function in relation to the traditional instructional function is also necessary.

These conceptual delimitations contribute to clarifying teachers' training needs and therefore, they enable us to establish methodological criteria for better planning of the required training actions, which we will refer to in the next section.

3. Criteria for designing and developing virtual training actions for university teachers

Once we reviewed the literature on university teachers' roles and competencies in virtual learning environments to delimit them, we had to define the criteria that guide the development of these competencies in teacher training actions. Therefore, we reviewed outstanding research on methodological aspects related to training experiences incorporating and promoting the use of ICT (Chickering & Ehrmann, 2008; Hung & Der-Thanq, 2001; Rossmann, 1999). We also analysed the diverse training actions being carried out in the various European countries taking part in the eLene-TT Project (*e-Learning Network for Teacher Training*), which is the framework where this experience we are relating has taken place (Guasch, Alvarez, & Espasa, 2006).

Despite the consensus on the need to promote and give prominence to teachers' social function, teacher training goals currently relegate it while they favour the development of competencies for planning and designing. It is interesting to note also that training is usually geared towards introducing technical resources into teaching. Insufficient attention is paid to the interdependence between technology and the corresponding pedagogical model (Alvarez, Guasch, & Espasa, in press).

The complex and changing character of teachers' roles and tasks makes it necessary to learn their professional practice comprehensively. They should be able to evaluate their own practice and to identify what they need to improve. They should be able to guide and promote their own professional development in a variety of learning situations. They need to be able to develop a professional knowledge based on teaching from their practice and, if possible, based also on research-based knowledge. This overview introduces the idea that learning in the work place is a necessity and an opportunity to improve. This idea corresponds to the definition of active learning (Dodge, 2000). Social interaction is a critical component of this approach. It has been typically applied in the context of learning activities that focus on problem solving. A realistic learning environment is crucial. Knowledge is part of the environment and the learner's interactions with the environment (McLellan, 1996).

All these assumptions were our starting point for defining some methodological criteria that supported the design of training practice, which we did in order to create operative guidelines that may help in the development and even evaluation of the teacher training practice. These methodological criteria have been organised into three essential aspects for planning formative proposals: objectives and goals, methodology and assessment. The criteria were defined according to the principles of socioconstructivism. All the criteria defined for this study are shown in Table 1.

4. Method

We attempt to analyse a teacher-training proposal that was designed by taking into account methodological criteria that may assist in developing competencies from training onwards. The criteria were defined from a conceptual approach to teacher functions, specifically in relation to the competencies and tasks that both differentiate and specify teaching and learning in virtual environments.

4.1. Sample

The teaching training proposal consisted of a workshop for teachers from the Department of Psychology and Education at the Open University of Catalonia (UOC), a fully virtual university from scratch, in which these teacher training needs were taken into account. Twelve university teachers took part. The workshop was

Table 1
Methodological criteria for the design of training actions in virtual environments.

Criteria	Objectives and goals of formative actions
	<ul style="list-style-type: none"> Learning new functions and associated competencies should include the integration of and inter-relation between the functions and tasks required for the successful development of the teaching/learning process in virtual environments Training practices must include learning goals that enable the development of competencies associated to the new teacher's functions including the development of abilities corresponding to the required technological profile
Criteria	Learning activities: instructive design of teacher training for online teaching
	<ul style="list-style-type: none"> To be aware of the particularities of different teaching and learning modalities incorporating ICT applications (totally virtual, blended or face-to-face). To ensure situated learning, which requires participants to act effectively with the acquired knowledge (learning-by-doing). This implies that learning requires interaction and collaboration so that participants are able to face real life(-like) educative situations To devise activities based on the development of authentic tasks, e.g., problem solving, case study, project design and development To promote collaborative learning and exchange of professional experiences, encouraging the creation of opportunities for raising the level of interaction among participants To use resources that promote "social dialogue" and mediation, e.g., exchanges, partnering, personalised assistance To implement the learning process by starting from the creation of learning guides, to set out the objectives clearly and explicitly, to anticipate the support required for processing the content of study materials and to facilitate meaningful and collaborative learning in a virtual environment To present examples of good practice and to stimulate the development of autonomous activities that call for the required knowledge and abilities
Criteria	Assessment of the process and the results of the practice
	<ul style="list-style-type: none"> To respect individual differences among participants, such as previous knowledge, occupational, cultural or other profiles, and to observe the characteristics of the participants' institutional environments To implement authentic interactive assessment procedures, e.g., co-assessment, assessment in pairs, self-assessment; portfolio assessment To carry out systematic, informative and formative assessment aimed for regulating the learning process To set out and share quality criteria for the expected learning outcome, while emphasising the possibility of contextualising and applying the results achieved To plan the assessment of the formative action itself in the short, medium and long run (feedback in relation to students' needs)

conducted by three trainers who all worked collaboratively throughout the process. All the participants were experts from the same subject area, and they had experience in virtual university teaching.

Table 2
Dimension of analysis: structuring and consensus on the conceptual basis for collaborative learning in virtual environments.

Dimension of analysis: indicators	Frequency (%) ^a	Examples (fragments of the participants' messages)
Consolidating notions and knowledge on the conceptual and methodological basis of online collaborative learning	17 (55)	<ul style="list-style-type: none"> "The teacher's role in collaborative group learning situation is essentially to facilitate the creation and development of the group during the joint resolution of study tasks: to structure the group, distribute roles and tasks, supervise its development, guide them towards common goals, help them to solve problems, detect misunderstandings, erroneous conceptions, enliven the debate, stimulate interdependence and communication, provide the necessary resources, maintain a nice atmosphere and sufficient motivation for shared learning tasks" The most effective challenges of this sort, given the type of students we have, are to be found in tasks of an applied nature. (...) real-life problems or problematic teaching/learning situations in which the students have to make a decision
The teacher's performance in activities intended to facilitate collaborative learning should be geared towards introducing aids	14 (45)	<ul style="list-style-type: none"> "Working in this environment makes it possible to place previous ideas and knowledge in a crisis (...) it encourages reflection on the proposed materials and the contributions made by the rest of the participants. This helps personalise the knowledge building process, thus encouraging autonomy and responsibility during learning" "To keep monitoring collaborative work; to create situations for self and joint assessment, with progressive interrogation and querying and not simply assessing the results of the collaborative work"
Total thematic units identified for the first dimension of analysis	31	

^aSource: analysis of the content of the messages posted in the forum for the first activity in the workshop.

4.2. Design and procedure

This study was based on the study case method (Sharan, 1998). The case we refer to shows a typical teacher training experience to develop competencies which enable the teacher to promote collaboration between the participants in virtual learning environments. This competency is highly relevant and teachers are increasingly demanding training in it, for which reason we designed a training action along this line.

Firstly, our workshop was designed in accordance to the methodological criteria for the design of training actions in virtual environments previously defined. Special attention was given to the concept of training aimed at developing competencies from within an educational context. For this reason, we took into account the current needs and previous experience of all the participating teachers (competencies required by the teachers according to concrete functions, roles and tasks), when setting the goals of the teacher training activity. The activities devised essentially respond to the principles of learning based on authentic tasks, learning which is guided, collaborative and constructive, i.e. learning-by-doing.

Secondly, we proceeded to evaluate the development and the results of the training action. We analysed the content of the messages exchanged during the workshop, which were recorded in the virtual classroom where the training action took place. The content analysis enabled us to identify 125 thematic units from the total of 43 messages. A thematic unit was defined as a single thought unit or idea unit that conveys a single item of information extracted from a segment of information (Rourke, Anderson, Garrison, and Archer, 1999). We used thematic units as our unit of analysis because they enable researchers to capture the essence of each communication.

We explored the learning process of the university teachers participating in our teacher training action in this second analysis. In order to carry it out, we defined three dimensions, which correspond to the objectives of every single teacher training activity and which are related to the development of virtual teaching competencies as they are defined in the theoretical section of this article. The dimensions focus on the development of teacher competencies aimed at promoting specifically collaboration in virtual learning environments at university level.

The following dimensions of analysis are the ones established to evaluate the development of teachers' competence to design virtual collaborative learning activities achieved by the teachers during our teacher training action.

1. *Structuring and consensus on the conceptual basis for collaborative learning in virtual environments*: consolidation of knowledge related to the conceptual and methodological basis of virtual collaborative learning.
2. *Critical analysis of the technological resources available for collaborative teaching and learning in virtual environments*: teachers proved to have sufficient ability to assess the advantages and disadvantages of this technological tool for learning.
3. *Design of collaborative activities for virtual teaching and learning environments in correspondence with the methodological criteria*: the teachers demonstrated knowledge transfer. They managed to convey content learned in practice by designing collaborative study activities for their own subject matters.

The first two dimensions enable us to check whether teachers can obtain sufficient knowledge about virtual collaborative learning, whether it is knowledge about the conceptual basis (dimension 1) or knowledge about the technological support that can be used (dimension 2). The third dimension is related to the skills to design collaborative learning activities in virtual environments for students. The development of these skills can be observed when looking at the accomplishment of the real tasks that the teachers participating in the training action can implement in their daily practice.

The data analysis was agreed upon by two of the researchers and was double-checked with a third researcher to check whether it enabled us to codify the message content in the line of our study and its goals, and that it was representative of the messages being analysed. A peer review process was also carried out. There was general agreement on the statement chosen for the content of the messages analysed for all the cases.

We conceptualise the peer review as a “process of exposing oneself to a disinterested peer in a manner paralleling an analytical session and for the purpose of exploring aspects of the inquiry that might otherwise remain only implicit within the inquirer’s mind” (Cohen & Crabtree, 2008, p. 334).

5. Results and discussion

We will show the analysis of the teacher training action as the first result in this paper, in order to state the manner in which the methodological criteria for developing competencies defined above are applied and the manner in which they work. The teacher training objectives, learning activities and the evaluation process are analysed by paying attention to the methodological criteria.

The second result will be the analysis of the messages recorded during the workshop, in order to evaluate the progress in the development of the competency for designing collaborative activities achieved by the university teachers participating in this study. This analysis is undertaken by paying attention to the dimensions defined.

We will show the results in the following sections.

5.1.1. *Characteristics of the workshop: methodology and instructive design of teacher training for virtual teaching*

The objectives set were aimed at developing competencies for the design of collaborative activities by using the tools and resources available in virtual teaching and learning environments: (1) to learn and share current theoretical referents about collaborative learning in virtual teaching and learning environments; (2) to recognise the different technological tools defined as Systems of Collaborative Learning, and their pedagogical potential, specifically the possibilities offered by the Synergeia system for the design and

development of virtual collaborative learning activities; and (3) to design collaborative learning activities in virtual environments by applying new knowledge. These objectives are closely related to the development of competencies linked to the teacher’s instructive and social function.

As it was based on the learning-by-doing principle, the workshop demanded collaborative work, through which the participants were able to exercise and develop their own abilities. The learning activities consisted in debates and group work activities, with the assistance of guidelines (scaffolding).

Participants are presented with reading texts in the first activity, the objective of which is debating their content in a forum. The study guide directs them to some key elements, for example the concept of aid in a virtual environment; the teaching process in virtual environments as a joint activity between teachers and learners; the nature of collaboration and the types of tasks that should be designed – such as positive interdependence, task subdivision in the design of collaborative activities and some restrictions and potential uses conditioning this process in virtual environments.

The second activity, which was also undertaken via forum, consisted in the joint assessment of the pedagogical potentials of a specific tool designed with the objective of facilitating virtual collaborative learning. This aim is achieved through two tasks: (a) analysing the pedagogical rationale of the Synergeia platform; and (b) identifying the pedagogical and technological potentials of Synergeia through guided exploration with learning guidelines. This tool is a technological platform designed with the objective of facilitating collaboration among participants. It is based on the BSCW environment (see <http://bscla.fit.fraunhofer.be>).

All the activities include knowledge building and negotiation practices within the Synergeia platform. The kind of design of the activities ensures the occurrence of situated learning, as well as participants’ construction of knowledge on the potential of Synergeia to promote collaborative learning in accordance with the learning-by-doing principle. All this also implies that interaction and collaboration are needed to learn. Therefore, the participating teachers are to face up real life-like education.

The proposal to carry out the practice and assessment in the Synergeia platform is justified by the need to introduce an example of “good practice” and to encourage the production of autonomous activities in which it is possible to apply the knowledge and abilities we want to develop. In turn, this task creates opportunities for increasing the level of interaction among participants, taking care of maintaining throughout the course the required mediation actions to promote dialogue and social construction of knowledge among the teachers taking part in the training practice. The trainers led the practice; and they took part in the collaborative activities in all the groups, boosting thus mediation and personalisation of the pedagogical aids.

It is important not to lose sight of the need for contextualising and applying the results of the learning process. This is the reason why the third activity requires the transfer of the knowledge being shared. The aim is for the participants, working as a team, to design a learning activity that promotes cooperative learning.

It is also important to pay close attention to the instrumentation of the learning process by expliciting its objectives. In order to facilitate learning in this activity, we devised a guide containing the basic aids to assist in achieving the main objectives of the workshop.

The guidelines informing the design are aimed to: (a) incorporate the proposal into the subjects taught at the UOC’s virtual campus; (b) to promote reflection about the pedagogical/technological principles and criteria of the teaching/learning process in virtual environments; and (c) take into account the technological and pedagogical

elements of the design analysed in the Synergeia platform, which may prove an interesting and essential addition to a given activity, bearing in mind the peculiarities of the UOC virtual campus.

This activity was group-based; and we got four teams. The grouping criterion was that the participants had to teach the same subject, i.e. that they shared the same referents and experiences, so as to facilitate decision making and cooperative work. Individual differences were taken into account thus: previous knowledge, occupational and cultural profiles and the characteristics of the participants' institutional environments.

Our main concern in the methodological design was the need to create activities based on the development of authentic tasks, which are relevant both for the teachers and for the educational vision the university subscribes to. The task assigned to the teachers was perceived as an opportunity to work in a team in order to solve common problems and concerns. That is why promoting collaborative learning and the exchange of professional experiences, i.e. encouraging a high level of interaction among participants, is important for us. Obviously, this aim cannot be achieved without using certain resources that promote "social dialogue" and mediation, e.g. exchanges, partnering and personalised help. Special attention was devoted to this issue during the activity, which was possible thanks to the trainers' coordination and teamwork. The trainers led and took part in the collaborative process in the various teams; and thus they reinforced mediation and personalisation of the pedagogical aids.

In accordance with the methodological guidelines above, the course had to include a process of authentic, formative and systematic assessment. A continuous assessment system was implemented. It was based on personal and group contribution to the collaborative task envisaged, emphasising co-assessment (authentic, formative and systematic assessment).

The forum is chaired by the trainers. Systematic feedback was provided during the activity. A summary with the most important elements arising in the discussion was also provided at the end of it. All this feedback is aimed at systematising and consolidating important concepts as well as to stimulate consensus among participants on key ideas about collaborative teaching and learning in virtual environments.

Along with this methodology, we instrumented a system of continuous assessment based on personal and group contribution to the envisaged collaborative task to give more weight to co-assessment. This consideration enabled us to establish and share the criteria of quality of learning, with an emphasis on examining the possibility of contextualising and applying the results achieved.

After completing the task, every group presented it in a forum, so that it could be analysed and commented on by the rest of the course participants by means of a crossed assessment activity. At the end, the participants were asked for their personal assessment of the learning experience. A questionnaire was used to gather information on their opinion about innovative aspects of the course, relevant aspects, and what would be worth repeating, including, omitting, improving and/or modifying in future editions of the course. This request enables us not only to assess the immediate results, but also to contribute to its improvement and necessary continuity.

5.1.2. Contribution of the training action to the development of the competency to design collaborative activities in virtual environments

We have identified three main achievements in relation to the contribution of the workshop to the development of competencies for teaching in collaborative teaching/learning in virtual environments. These achievements correspond to the three dimensions of

analysis defined. Every dimension enables us to focus the analysis in one of the activities of the workshop: (a) structuring and consensus on the conceptual basis for collaborative learning in virtual environments (first activity); (b) critical analysis of the technological resources available for collaborative teaching and learning in virtual environments (second activity); and (c) design of collaborative activities for virtual teaching and learning environments in correspondence with the methodological criteria (final activity).

5.1.2.1. Structuring and consensus on the conceptual basis for collaborative learning in virtual environments. The first result – corresponding to the first activity in the workshop – shows the reinforcement of notions and conceptual knowledge on the conceptual and methodological basis for collaborative virtual learning. The following assertions taken from the content summary in the first debate support this first inference (see Table 2).

5.1.2.2. Critical analysis of the technological resources available for collaborative teaching and learning in virtual environments. The second result of our workshop shows the teachers' adoption of a critical analysis position in relation to the usefulness of the technological resources available for collaborative learning processes.

The teachers proved to have sufficient ability to assess the advantages and disadvantages of Synergeia, the tool for learning used in the training action. A range of interesting references were discussed by using the space this platform contains for knowledge building and negotiation, which enabled the contextualisation of the knowledge being shared and built by the teachers participating in the course.

The strong points of this system with regards to virtual collaborative learning relate to the technological support available for the required interdependence during tasks entailing cooperative knowledge building.

The fact that Synergeia was not designed for university environments is the reason why some limitations were also identified. These limitations have to do, mainly, with its lack of adequacy to the particularities of university teaching and to the diverse range of cognitive activities of virtual university students. A summary of the analysis of the messages on this topic that the participating teachers sent one another is shown in Table 3.

Taking into account the above reflections which stem from what may be described as a "case study", we can reach a consensus on some generalisations that may serve as guidelines to decision making on the introduction of technological tools and resources as a support for collaborative learning in a virtual university environment. Concerning this, the opinions of the teachers taking part in the workshop concurred in pointing out two essential requirements a ICT tool and/or resource should meet for it to be considered useful in collaborative teaching/learning:

- As a support for teachers' social function in a virtual environment in terms of facilitating and guiding learning:
 - They must offer aids enabling the creation and management of collaborative work groups: decision making, task distribution, setting out responsibilities, addressing queries and problems, exchanging knowledge, motivating students towards joint learning, etc.
- As a support to virtual knowledge construction and learning:
 - They must offer diverse spaces for communication and the organisation of content with activities enabling decision making, exchange and personalisation of aids, i.e. an architecture adjusted to the nature of virtual collaborative tasks.

Table 3

Dimension of analysis: critical analysis of the technological resources available for collaborative teaching and learning in virtual environments.

Dimension of analysis: indicators	Frequency (%) [*]	Examples (fragments of the participants' messages)
The usefulness of the tool to promote interaction	16 (29.6)	<ul style="list-style-type: none"> • "It's useful in bringing about interaction; it helps with structuring interventions and participation"
Technological difficulties of the tool affecting interaction	11 (20.4)	<ul style="list-style-type: none"> • "The environment design is overcrowded with stimuli, which may cause confusion or distraction and make self-management more complex in the learning process within the platform"
The usefulness of the tool to promote the joint construction of knowledge	17 (31.5)	<ul style="list-style-type: none"> • "It includes possibilities for categorising individual opinions and proposals, which helps in collective knowledge building" • "The possibility of asynchronous cooperative knowledge building by means of the creation of conceptual maps is one of the system's strongest points"
The obstacles to promote the joint construction of knowledge put by the tool	10 (18.5)	<ul style="list-style-type: none"> • "The architecture of the spaces for knowledge building and negotiation turns out to be "corseted" • "It does not take sufficient care of individual differences in learning styles, particularly with regards to scientific knowledge building, so characteristic of a university environment"
Total number of units identified for the second dimension of analysis	54	

^{*}Source: analysis of the content of the messages posted in the forum for the second activity in the workshop.

- Utilities encouraging problem discussion, querying, debate and consensus during joint knowledge building.
- Resources encouraging self-management of knowledge, self-regulation of the learning process, systematic and formative assessment, self-assessment and co-assessment included.

5.1.2.3. *Design of collaborative activities for virtual teaching/learning environments in accordance to the methodological criteria.* Lastly, the third result, which corresponds to the third activity "Design of a collaborative activity in the context of their usual teaching practices", suggests knowledge transfer because the participants manage to convey content learned in practice, by designing collaborative study activities for their own subject matters. The results achieved with this activity were made possible -to a great extent- because of the suggestion of carrying out the work in groups. During the development of the task assigned to the groups and after it, all the proposals were revised and jointly corrected, which no doubt had an impact on the results achieved.

Since the teachers participating in this activity were divided into four working groups, we decided to classify the analysis of the results as part of the analysis of the product instead of as part of the analysis of the messages teachers sent one another. However, we must highlight that a remarkably high number of messages was achieved by all the groups. There were 28 messages in total at the end of the activity. They were contributions to the joint design of the collaborative activity in which the knowledge acquired in the previous activities was applied and/or transferred.

Great care was taken by teachers in key design issues, such as the setting out the learning objectives and tasks, considerations about the characteristics of the materials, the organisation and management of the classroom space, the definition of student roles – both individually and in groups – and those of the teachers during the completion of the task, the anticipation of the educational support or working guidelines were going to be necessary for building cooperative knowledge and proper collaborative functioning, interdependence and communication, the implementation of the assessment system while taking into account feedback and the diversity of procedures to promote self-regulation and monitoring of the collaborative learning process.

Several proposals for collaborative teaching/learning in virtual environments arose from the four teams created for this purpose: (1) case study; (2) problem solving; (3) group research; and (4) group discussion. The strength of the design proposed lies in the definition of teaching support as a guide to and facilitator of

collaborative learning, particularly for encouraging the building of cooperative knowledge by groups. It is worth pointing out that all the designs made by the participants put emphasis on mediation and the teacher's social function, which is evidence that supports the statements we made about the integration of teacher roles at the beginning of this paper.

In general, all the activity designs proposed by the participants reflected their authors' concern for meeting the essential requirements of collaborative teaching/learning, a fact which highlights by itself the contribution made by the workshop to the development of competencies related to the improvement of teachers' social function. However, no adequate solution was found to meet the requirements of collaborative learning assessment in virtual environments, such as the criteria for assessing individual contributions, interdependence, specific procedures for systematic assessment, self-assessment and/or cooperative assessment.

In relation to this, a consensus was reached in the joint evaluation made at the end of the workshop. The participant teachers pointed out that one of the innovative aspects of the course was the possibility it offered to share experiences with others teaching the same subjects and to put into practice common strategies for the improvement of teacher practices. Regarding the course content, there was a positive response to the new collaboration tools, in particular to the Synergeia platform. Concerning the methodology, the systematicity of activities and tasks was considered a positive aspect, together with the co-assessment procedures and, above all, the possibility of sharing and jointly assessing the learning results. Furthermore, the theoretical study of the matter was also considered relevant, as it helped clarify the concepts related to collaborative teaching/learning in virtual environments.

Lastly, the lack of sufficient time to devote to the course activities was singled out as the most unfavourable aspect. The recommendations for improvement and changes in future editions of the course focused on the possibility of going into an in-depth analysis of specific issues of collaborative activity design, such as communicative channels and spaces for building, sharing and discussing knowledge, and the procedures for its assessment.

6. Final considerations

As pointed out at the beginning of this paper, we intended to analyse a teaching training experience for university teachers in virtual learning environments, the objective of which was to develop competencies related to collaborative learning in virtual

environments, with a view to identifying the methodological aspects facilitated the development of the objectives set. We also intended to identify the aspects that hindered the execution of the objectives, taking into account the criteria identified as key elements in the design of a training practice.

We would like to highlight the need to observe in an integrative manner the diverse teacher roles/functions whilst designing training proposals for the development of competencies. This need is equally vital when the training action focuses on a single competency, such as our focussing on the design of collaborative activities, so that the re-conceptualisation of teacher functions is explicitly acknowledged in teacher training practices.

In this sense, our proposal intended to train teachers to develop the functions outlined at the beginning of this paper. Authors such as Williams (2003) and Egan and Akdere (2005) propose teachers' functions and competencies that are difficult to develop by a professional working on their own. For this reason, we also advocate for a teaching training model based on collaborative learning among different professionals: the teacher, an expert in the subject matter who is competent in the functions outlined; the tutor who guides the student throughout their university course; and management staff to deal with administrative and technological aspects among others.

In line we followed above, the evidence presented in the teacher training experience we have described enables us to assert that the methodological criteria underpinning the experience facilitate the learning process needed for the development of teachers' competencies for collaborative teaching/learning in virtual environments. From our viewpoint, the methodological criteria presented and contrasted throughout the experience shed light on the process of planning and designing teacher training proposals to meet the current needs in higher education in terms of the development of competencies for teaching and learning in virtual environments.

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