Designing pre-service teacher training based on a combination of TPACK and Communities of Inquiry

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Abstract

A main challenge in designing pre-service teacher training courses that promote teachers to elaborate on the learning opportunities that ICT can provide to students, is to make it happen in a constructive manner promoting reflection, collaboration, and discourse. Aiming to contribute to this direction of research, we propose a design rational for blended learning scenarios for pre-service teacher training combining Technological Pedagogical Content Knowledge (TPACK) framework with Communities of Inquiry (CoI) and viewing teacher training as an authentic process involving participants in learning design activities. TPACK is used as the basis for designing the curriculum and content of the course in the form of learning design activities for trainees. CoI is used as the basis for designing learning strategies, support and learning activities that promote higher levels of learning in a blended learning context. Based on the proposed rational, the design specifications of the one-year teacher training course on technology enhanced learning provided by the School of Pedagogical and Technological Education (ASPETE) in the context of the postgraduate certificate in education for graduates of a variety of disciplines, are presented and discussed.

1. Introduction

Nowadays, pre-service teachers, as digital natives (Prensky, 2005) who have grown up with technology, are usually competent in using information and communication technology (ICT) in their everyday lives but in most cases they have not a clear idea of how to integrate ICT into teaching and learning. Furthermore, teacher training on ICT usually focuses on either technical skills or background knowledge of ICT rather than pedagogical uses invoked by ICT use (Jung, 2005). However, technologies have their own potential, putting their own constrains and affordances on the nature of possible content representations and learning interactions. Moreover, taking into account the rapid rate of evolution of digital technologies, the use of technology cannot be seen as an isolated skill focusing on currently available tools, but as an important aspect of teacher knowledge along with the variables related to content and pedagogy (Mishra and Koehler, 2006). What seems important in teacher training today is the interweaving of content, pedagogical and technology knowledge in an inseparable way. Therefore, a main challenge in designing pre-service teacher training courses that encourage teachers to elaborate on the learning opportunities that ICT can provide to students, is to make it happen in a constructive manner, promoting the design of artifacts, peer collaboration, and reflective discourse (Schlager & Fusco, 2004). To this end, learning by design is a promising
approach focusing on constructing artifacts instead of lecturing, giving learners the control over their learning. Learning by design demands that training is moving to design-based activities where “design is experienced in action, depends on recognition of quality, is understood in dialogue and action, and involves reflection in action” (Mishra & Koehler, 2003). Artifacts that promote the interweaving of content, pedagogical and technology knowledge in an inseparable way can be learning designs. Learning designs include descriptions of learning tasks, resources and support provided by the instructor (Beetham and Sharpe, 2007; Donald et al., 2009). Dalziel (2009) describes learning design as ‘a descriptive theory of educational activities and processes rather than theory about how students learn’ (p. i). More specifically, ‘the focus is not the discipline content of education, as important as this is, but the activity structures used to help students understand this content’ (p. ii).

In the area of higher education and training, blended learning and Communities of Inquiry (Garrison, Anderson, & Archer, 2000) that have attracted a lot of attention, assume that activities that facilitate higher learning occur within a community and the interaction of three core elements: social presence, cognitive presence, and teaching presence. The design of such a flexible, learner centered teacher training course presents numerous challenges, some of these related to pedagogy and others to technology.

Aiming to contribute to this discussion, in this paper we concentrate on design specifications of blended learning scenarios for pre-service teacher training viewing teacher training as an authentic process involving participants in learning design activities taking place face-to-face (f2f) and online. Critical issues that are discussed are: (a) how to organize blended learning to promote learning design construction, collaboration and reflection, (b) what type of knowledge and skills should pre-service teachers cultivate in order to become able to effectively integrate technology into teaching.

2. Design rational for training pre-service teachers on technology enhanced learning

In the design rational proposed in this section for training pre-service teachers on Technology Enhanced Learning, we adopt a view of teachers as designers of innovative content working individually and collaboratively, discussing and interacting with the instructor and their peers. Collaborative, reflective activity would in turn demand overcoming the longstanding traditional perception of the private, individual nature of teaching and the fact that in schools, teachers work more in isolation than in collaboration with colleagues (Little, 1990). In particular, we propose teacher training to take place in an authentic learning environment based on blended learning and promoting communities of inquiry.

There is ongoing research investigating how to create effective blended learning experiences that incorporate both face-to-face and online learning tasks. The design rational that we propose for constructivist pre-service secondary education teacher training on Technology Enhanced Learning combines TPACK with Communities of Inquiry (CoI). TPACK is used as the basis for designing the curriculum and content of the course in the form of learning design activities for trainees. CoI is used as the basis for designing learning strategies, support and learning activities that promote higher levels of learning in a blended learning context.

In particular, Technological Pedagogical Content Knowledge (TPACK) is used as a framework to understand teachers’ knowledge required for effective technology integration as it focus on connections, interactional, affordances and constraints between and among technology, content and pedagogy, emphasizing their complex interplay. Thus, TPACK acknowledges three interdependent components of teachers’ knowledge, technology knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), as well as pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and all three taken together as technological pedagogical content knowledge (TPACK) (Mishra and Koehler, 2006).

Technology knowledge involves the skills required to operate particular technologies. A main design decision for a training course is the technologies that will be included. Content knowledge refers to content covered in school within the trainees' field. Moreover, it is quite important that trainees understand the nature of knowledge and inquiry in different fields. Trainees are usually of different disciplines, considered competent in their own field. The course should cultivate the link among the scientific knowledge with the subjects taught in school. Pedagogical knowledge is about specific pedagogical approaches including teaching techniques or methods, students' needs and
individual characteristics, strategies for assessing student understanding. A main design decision for a training course is the technologies that will be included. Other types of knowledge that need to be cultivated focus on the interaction of technology with content and pedagogy assuming that trainees have sufficient pedagogical content knowledge. A main decision for the course is the type of learning activities that cultivate skills linked with technological pedagogical knowledge and technological content knowledge. Thus, three types of learning activities should be designed for trainees: (a) TPK activities that raise questions about the appropriate matching of technologies with various pedagogical approaches enabling trainees to understand that several technologies might be used for a particular task, to choose the most appropriate ones, and to apply pedagogical strategies for use of these technologies, (b) TCK activities that raise questions about how difficult concepts or misunderstandings might be faced using technology, enabling trainees to understand the constraints and affordances of various technologies in the representations they produce for their subject matter, as well as how the subject matter might differently being treated through the use of technology, (c) TPACK activities that raise questions about how a new technology might best serve specific learning outcomes, challenging trainees to go beyond all three types of knowledge.

Based on the nature of the contents of the training course, below we discuss how the CoI framework might support the development of a community among trainees in order to better support the cultivation of the different types of knowledge described above. According to the Community of Inquiry framework (Garrison, Anderson, & Archer, 2000) learning experience occurs in the area that the social presence, cognitive presence, and teaching presence share. Social presence relates to how members of a group can share and interact. It evolves from “open communication (interaction), to purposeful academic exchange (discourse) and to achieving a feeling of camaraderie” (Garrison and Arbaugh, 2007). Cognitive presence is defined as the extent to which trainees are able to construct and confirm meaning through sustained reflection and discourse. The practical inquiry model is proposed to guide the design of learning activities that develop cognitive presence, proposing a four phase process where trainees move from understanding the problem/issue through to exploration, integration and application. Teaching presence is what sustains the learning experience and encourages inquiry. Teaching presence is considered valuable in ensuring that trainees’ interactions keep focused on a specific direction. It consists of design, facilitation, and direct instruction.

A question emerging is how the three presences may guide the design of learning activities that better support the various types of knowledge of TPACK discussed above in f2f meetings and on-line. At this stage we make some assumptions, suggesting that the separate components and particularly technology and pedagogical knowledge can be effectively cultivated in f2f meetings, whilst TCK, TPK and TPACK activities should include individual and collaborative online work and reflection resulting in specific artifacts. Teaching presence is dominant at the f2f meetings, although trainees work individually on quite directive learning activities that aim at their familiarization with the main features, functions, terminology of technology and pedagogical approaches. Individual work is proposed before collaborative construction of a technology enhanced lesson to ensure that all trainees will attain a common background before entering to the collaborative session.

3. Design specifications of a training course on technology enhanced learning

The one-year pre-service teacher training course on Technology Enhanced Learning provided by the School of Pedagogical and Technological Education (ASPETE) in the context of the postgraduate certificate in education for graduates of a variety of disciplines taking place in Athens, is designed for the current academic year following the abovementioned rational. The design specifications adopted are:

Technology knowledge: Pre-service teachers as designers of technology enhanced courses become familiar with a range of technologies and digital resources. Three types of digital tools/environments have been selected as adequate for promoting discourse on learning design issues such as the role of multiple representations in learning, the role of students’ individual characteristics on learning, authentic approaches in student assessment: Web 2.0 tools, learning design tools and authoring tools of adaptive learning environments. Moreover, the tools/environment considered are web-based and content free in order to allow the design of interdisciplinary courses, allow the design of objects that can be embedded in learning activities, allow web-based access viewing courses as a sequence of activities.
**Pedagogical knowledge:** the Learning by Design framework (LbyD) which is based on the conceptualization of ‘New Learning’ (Kalantzis & Cope, 2012) is used as a common language among teachers to enable communication and co-construction of learning environments enhanced with technology. The LbyD framework uses eight ‘knowledge processes’ (i.e. types of activities) (Kalantzis & Cope, 2012): (i) Experiencing the known, (ii) Experiencing the new, (iii) Conceptualizing by naming, (iv) Conceptualizing with theory, (v) Analyzing functionally, (vi) Analyzing critically, (vii) Applying appropriately, and (viii) Applying creatively. The mindful and appropriate deployment of the range of Knowledge Processes through a course is intended to foster higher order thinking skills and deeper learning.

**Trainees work individually and in groups:** Trainees participate in f2f lessons and workshops about various web-based tools/environments and pedagogical theory in order to cultivate technology and pedagogical knowledge. Furthermore, they participate in e-discussions with peers, and work out specific assignments that demand the design and authoring of content (learning activities/scenarios) using specific web-based tools/environments to cultivate TCK, TPK, and TPACK (see Table 1). Moodle is used as the main technological infrastructure where the learning experience sits on.

In particular, TCK and TPK are cultivated online through social learning activities that ask trainees to share ideas about the educational potential of particular resources and technologies for their discipline in discussion forums. Social presence is promoted through open communication at class level. Then, TPK is further cultivated as trainees collaborate in small groups online to design artifacts, i.e. simple learning activities for a specific target group of students, and finally they individually develop learning activities for students where they (i) decide on the topic taking into account curriculum of subjects taught at school, (ii) define learning outcomes, (iii) decide which Web 2.0 tools to involve, (iv) develop digital learning objects based on a specific knowledge process according to the LbyD framework, and (v) provide a description of the learning activity involving particular teaching techniques. Trainees are asked to argue on the knowledge process underlying the activity and explicitly describe the pedagogical and technological decisions made. Assessment criteria are announced as design quality specifications. In case trainees select to design a learning activity on their own discipline, then TPACK is also cultivated.

| Topic | Learning Activity | Knowledge | Presence |
|-------|------------------|------------|----------|
| Educational and multimedia resources on the Internet | **F2F:** Workshop on educational & multimedia resources on the Internet<br>**Online:** asynchronous discussion on the usefulness of educational & multimedia resources at class level | TCK | Teaching |
| Web 2.0 tools: graphical representations (word clouds, timelines, mind maps), digital story telling (prezi, comics, interactive posters, video), assessment (rubrics, crossword, puzzles) | **F2F:** Workshop on the use of various categories of Web 2.0 tools<br>**Online:** asynchronous discussion on the usefulness and the appropriateness of various Web 2.0 tools for their own field at class level | TCK | Teaching |
| Learning by Design framework, Teaching techniques | **F2F:** Workshop on designing activities based on the Learning by Design framework using appropriate teaching techniques<br>**Online:** (1) asynchronous discussion on how the Learning by Design framework might support the design of learning activities at class level (2) asynchronous discussion for collaborative design of an artifact based on the LbyD framework and the various Web 2.0 tools in groups of 5-6 trainees organized randomly | TPK | Social |
| Individual Assignment: Develop artifact, i.e. a learning activity that triggers a specific knowledge process and embodies specific Web 2.0 tool(s) & resources. | TPK/TPACK | Cognitive |
| Learning Design tools/Authoring of adaptive content | **F2F:** Workshop on the LAMS/INSPIREus authoring environment<br>**Online:** asynchronous discussion on the usefulness of the digital environment (LAMS/INSPIREus) in cultivating learning design skills at class level<br>**Collaborative Assignment:** Develop and author a course design for LAMS or INSPIREus based on the LbyD framework working in groups | TPK | Social |
| Web 2.0 tools: communication & collaboration (wikis) | **Assignment:** Peer review of course designs using wiki | TPACK | Social |

Table 1. Specifications of the teacher training course on technology enhanced learning
TPACK is cultivated collaboratively as trainees collaborate in order to design an interdisciplinary course merging
learning outcomes from their subject areas (if possible), and authoring it using a learning design or an adaptive
learning environment. Trainees work in groups formulated based on their psychological characteristics and
 technological self-efficacy. Each group has its own forum on the Moodle to communicate and collaborate. TPACK
is expected to be further enhanced through a reflective discussion topic on the potential of the technological
environment they used to author their course, in cultivating learning design skills. Both social and cognitive
presences are expected to be identified in the collaborative design of a course and the preceding discussion. In
training courses that have as target group trainees from a variety of disciplines, we have to balance among
discipline-oriented and interdisciplinary goals. In this case we invest on the second approach, asking trainees to
develop interdisciplinary courses and set goals from their own perspective, if this is possible.

4. Conclusions and Further Research

Aiming to contribute to the design of constructivist pre-service teacher training courses, in this paper we propose
a design rational of blended learning scenarios including technological as well as pedagogical aspects, and viewing
teacher training as an authentic process involving participants in learning design activities as well as in supporting
and reflective discussions. The theoretical underpinnings of the design rational lie in the TPACK and Communities
of Inquiry frameworks. Currently, a training course organized based on the specific design rational is in progress
and our future plans focus on data collection that will allow us to evaluate the adequacy and efficiency of the content
in cultivating TPACK knowledge as well as to evaluate how and in what extend the social, cognitive and teaching
presences have been developed.

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