How Do We Prepare Vocational Teachers for the Demands of the Digital World? From Paper Prototype to Teacher Training

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Abstract: This paper describes a vocational teacher training programme designed by utilizing a design science approach from 2007-2016. The programme served as a testbed for digital learning and mobile learning solutions; afterwards, which were utilized in other teacher training programmes and global educational services provided for universities and vocational institutions abroad. The programme has aimed to meet the challenges of the working world and digitalization of society. The current paper seeks to illustrate the changes made in the programme in terms of the learning management system, pedagogical methods, tools and practises.

Introduction

This study took place at the Haaga-Helia School of Vocational Teacher Education, located in the capital city of Finland, Helsinki. Since 2008, the school has offered a web-based vocational teacher education program while also serving as a testbed for digital and mobile learning experiments. Therefore, it continually attempts to innovate with novel pedagogical models while seeking better tools for its teaching and learning activities. Utilized in our global educational programmes to other countries, the programme's successful solutions were also eventually applied in numerous other teacher education programmes.

This study has employed a design science approach to create a step-by-step teacher training programme responding to the needs of working life and our students' expectations. A design scientist attempts to engineer innovative educational environments and simultaneously conducts experimental studies of those innovations (Brown, 1992). The experimental studies in this study have been carried out in a web-based teacher education programme since 2007. Design science aims to ascertain what works in practice, and the teacher training programme has provided an excellent context for this goal. The objective of this research is to illustrate the inner workings of a web-based teacher training programme – from paper prototype to its current format. Therefore, this paper describes the methods, models and digital environments utilized over the course of these years. The teacher training programme has faced several major curriculum changes, and it has been surrounded by changes in people's working lives. When we started the programme, we used computer labs on contact days. With the emergence of the bring-your-own device concept, the need for a lab disappeared. The lab was torn down and refurnished. Students today use their laptops, tablets and smartphones for their studies. Digitalization has become ubiquitous in society, requiring novel competences for teachers as well as new pedagogical solutions and technologies. This programme has aimed to support these new competences for teachers in the context of 21st century learning.

Background of the web-based teacher training programme

In 2006-2007, there was increasing interest in taking advantage of e-learning in our teacher training programme. We benchmarked other teacher training programmes, interviewed our faculty members and scouted the literature to develop a wider understanding of e-learning solutions that might meet our needs. We used a paper prototype as a development method to make a decision: should we design a separate web-based teacher training programme or just extend the existing teacher training programmes with e-learning features? Ultimately, we decided to conduct a web-based teacher training pilot programme, agreeing that if the programme met our objectives, it would become one of the official teacher training programmes the following year. Five key features of the pilot programme were defined during the paper prototype process. First, the programme would follow a learner-centred approach in which students worked actively within their own learning processes. Second, the programme would be based on collaboration between students—it would not be possible to study in the programme without participating in collaborative learning situations with peer students and one's own workplace colleagues. Third, it would not be possible to send assignments for assessment over email. Instead, we wanted to encourage students to become familiar with e-learning opportunities, social media and cyberspace. Fourth, we sought to avoid a situation in which technical solutions would become obstacles to

study in the programme: students with basic information communication skills should be able to study in the programme. Fifth, in addition to online sections, we decided to include eight contact days, because most of the teachers also continue teaching in a face-to-face context, thus seeing the value of contact meetings in the learning process.

To gain a better understanding of how our students in the teacher training programmes were using e-learning and social media in their work as teachers, we conducted an inquiry in 2008. 245 of 280 students responded to the inquiry, which was organized during contact days. The following figure illustrates the answers to this question: Do you use learning management systems (LMS, e.g., Moodle or WebCT), emails or Internet in your teaching?
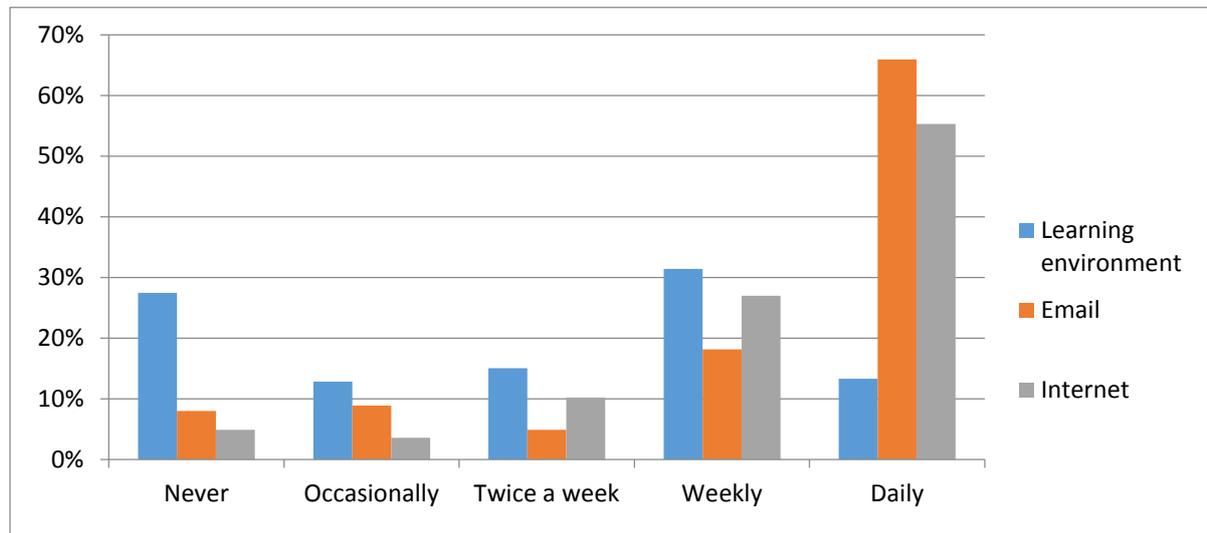

Figure 1: The use of LMS, emails and Internet in the students' own teaching (Aarreniemi-Jokipelto, 2010).

Almost 80 percent used email either daily or weekly, and over 70 percent utilized Internet either daily or weekly. The use of LMS was negligible compared to the use of email and Internet. 25 percent of the students stated that they didn't use an LMS at all. Figure 2 presents responses to this question: Do you use social media services in your teaching?
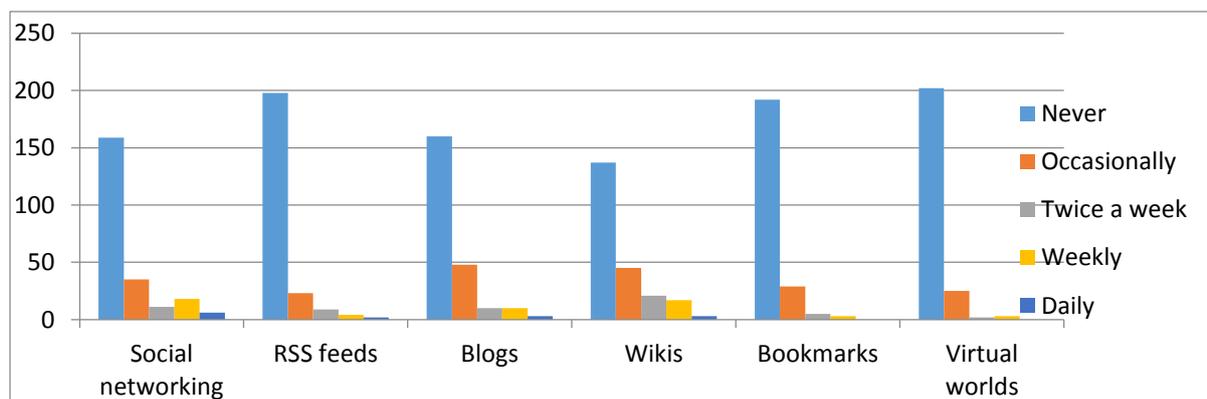

Figure 2: The use of social media services in students' own teaching (Aarreniemi-Jokipelto, 2010).

Approximately 80 percent of the students reported not using RSS feeds, bookmarks or virtual worlds in their teaching. About 60 percent stated that they did not use social networking, blogs or wikis when teaching. Our students reported using emails and Internet often, but in 2008, they rarely employed social media services in their work. We made a decision to promote social media tools and pedagogical methods suitable for social media in the web-based teacher training programme because we expected such tools to become instrumental in coming years.

Students in the web-based teacher training

The characteristics of students in our teacher training programme differ considerably from those in similar programmes in other countries. Most of our students already hold a Master's or Doctoral degree, and they taking their pedagogical studies in one- or one-and-a-half-year programmes. The average age for students is 40 years, and most of them have family and work duties in addition to their studies. They usually hold jobs as teachers in vocational schools, but some of them work for other educational institutions (i.e., universities, basic education schools), companies or organizations. The students are dispersed throughout Finland, but the majority lives in the capital city area. A small number of students study abroad for part of or the entire year, and due to globalization we expect numbers in this group to increase in the future.
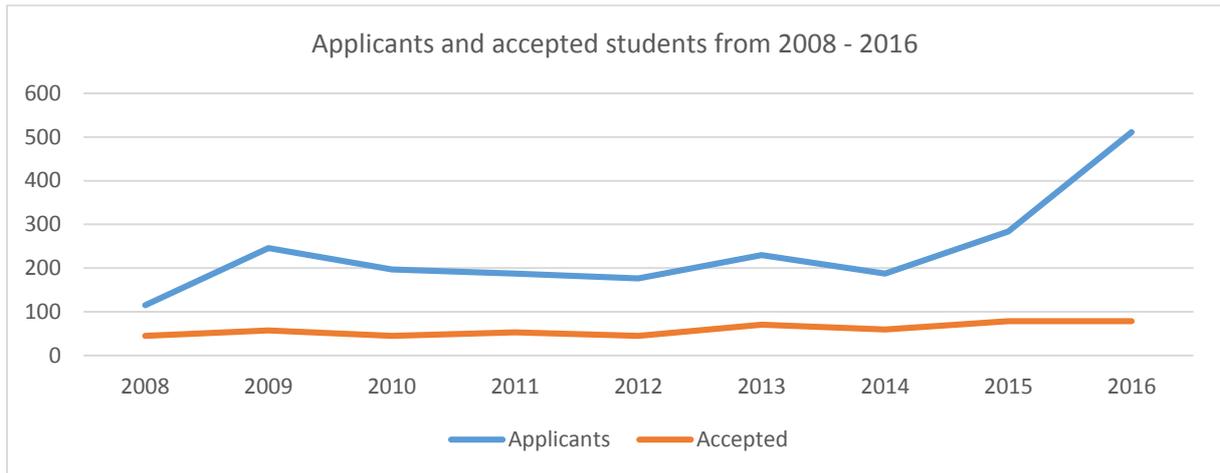

Figure 3: Applicants and accepted students to the web-based teacher training programme from 2008 – 2016.

The number of accepted students has varied from 45 to 78 students per year, but there has been greater variation in the number of applications. Figure 3 illustrates that a large number of applications are received, but some of the applicants fail to fulfil the programme's prerequisite requirements. We had a pilot group in 2008, and because the programme was not advertised at all, we received only 115 applications. When the pilot became an official vocational teacher training programme in 2009, the number of applicants increased over 114 percent. From 2010 to 2012, the number of applicants remained stable (197,187, 166), and thereafter, it slightly increased before decreasing. The number of applications increased 52 percent in 2015 and 80 percent in 2016 compared to the previous year. During the last two years, many teachers lost their jobs at Finnish vocational schools. It appears that teachers have sought to ensure their positions by receiving the teacher training certificate, which is required to hold a permanent teaching position in a Finnish vocational institution.

Learning management systems and joint teaching

For the first three years, the programme used the Moodle learning management system (LMS) as a gateway to all learning activities. From 2011 to 2012, this platform was replaced by Ning (http://www.ning.com). Ning is not an LMS, but it was created to serve as a platform for communities. Therefore, we needed to extend the Ning with social media tools, such as blogs, wikis and podcasts in order to achieve all of the requested functionalities and features.
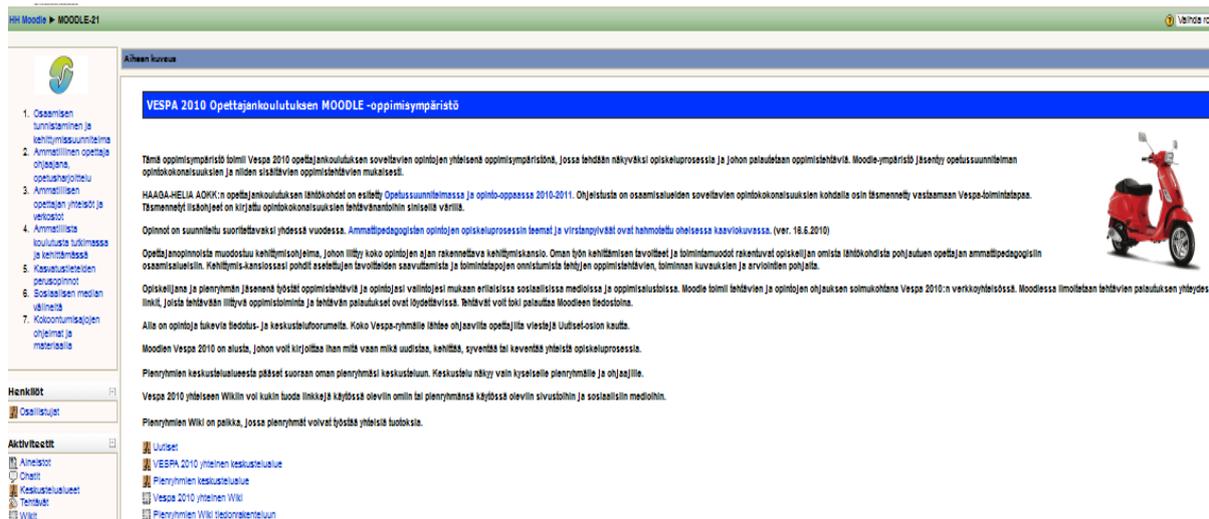
Figure 4: The Moodle learning management system.

There are a number of reasons why we decided to abandon Moodle. First, there had been several technical problems with Moodle, and teachers did not embrace the functionalities that IT support allowed us to use. Secondly, there was a desire to create novel, more learner-centred models, which was not possible on Moodle. Thirdly, some students complained about Moodle and felt that it was confusing and unattractive. During the Moodle usage year, we extended the LMS with social media tools, but there were many challenges. Our idea had been to have one gateway to learning activities, but Moodle did not support the integration of social media tools at that time, causing confusion for students.

Figure 5: The Ning learning environment (Aarreniemi-Jokipelto, 2012).

We settled on Ning because it had been used widely in educational contexts (see e.g., Galasso 2011), and most of the teachers had previous experience with it. Ning serves as a place for learning materials, assignment instructions, guidance letters and communication. Several social media services are integrated into Ning, including Glogster, Diigo, Knovio and Voicethread. Our objective was to create more engaging visual learning environments and to support different learning styles by replacing text-format materials with audio, images, videos and a combination of different formats. During the first years of the program, the guidance letters were totally text-based messages shared on Moodle, but we launched an e-zine through Ning that included audio, charts and pictures. To create the e-zine's new appearance and form, we experimented with several social media tools, such as Glogster, Knovio, and Voicethread. The guidance letter produced with Glogster resembled a poster; with a quick glance, one could determine the main themes. Students especially liked the checklist and visual appearance of the guidance letter. In the second Ning year, Glogster was chosen

for all e-zines, because of its visual appearance and ease of use as well as the positive feedback from students. All of these tools were integrated into Ning, because Ning itself did not provide this kind of functionality, and we wanted to continue 'the one-door-to-all-learning-activities' idea (Aarreniemi-Jokipelto, 2012).

For the first five years, the teachers in the programme used a joint Moodle or Ning environment, but after that, each teacher decided on the environment that s/he wanted to use with his/her students. There were two reasons for this decision. First, the teachers' competences in digital learning and tools ranged from beginner to expert level, so it had been challenging to find a comfortable level of digital learning usage that simultaneously supported the programme's goal to serve as a testbed for novel digital learning experiments. Second, there had been challenges in the usage language even though all of the teachers were native Finnish speakers. We had had a joint LMS in which three to four teachers worked together with all students. We wanted to have transparency between teachers and students in learning. Therefore, teachers cooperated with each other by planning online learning situations, producing digital introductions to learning modules, making digital instructions to learning situations and producing digital guidance letters. The joint teaching idea had many advantages. It provided an opportunity to learn from each other, to work in a large learning community and to ensure transparency of learning among teachers and students. From a practical point of view, it also meant that all teachers were not producing the same introductions, guidance letters and so on. Instead, one teacher produced this document for us all. At the same time, we also met with our students on contact days, partly in joint groups, and partly in our respective classes. We also had online guidance meetings with our own students, observing their teaching on our own. Thus, there were situations in which we worked alone, but there were also group situations with other teachers and their students. According to student feedback, there were differences between the instructions received from one's own teacher compared to the online instruction co-created in collaboration with other teachers. Sometimes there were misunderstandings, because a teacher in the online instruction or guidance letter had used slightly different terms than one's own teacher. After we had sent guidance letters, we ended up explaining what the other teacher had actually meant. Therefore, we decided to abandon the joint LMS, but teachers continue to partially plan their learning situations together and to co-teach at times.

In recent years, each teacher in the programme has chosen the tools s/he wants to use. In practice, this self-selection has meant the use of Google tools combined with free social media tools. However, we have noticed fewer joint activities between teachers compared to the first years of the programme. Nonetheless, the teachers seem to enjoy this more flexible situation, allowing both joint and solo teaching and guidance.

From integrated learning management system to distributed learning model

The LMS exemplifies using an integrated model in digital learning. Integrating all learning resources and activities into a learning environment, it provides easy access to learners. Traditionally, the teacher organizes and creates all learning materials and activities in the LMS. The teacher also selects external tools to integrate or link to an LMS, following the idea that there is only one gateway to all learning activities.

By comparison, the distributed model is a mash-up, combining user-selected tools and networks on one administrative interface (Syvänen, Muukkonen, Sihvonen, 2009). According to the model, students can build their personal learning environments (PLE) from the tools they use during leisure time, such as blogs and wikis. The distributed model typically includes more tools than the integrated model. In addition, the final combination of tools may vary from student to student.

In our web-based teacher training programme, we have moved from the integrated model towards the distributed model step by step, and we have now reached the distributed model stage. The curriculum is available on the website, and the teachers have their own learning environments to be used for instructions on assignments and announcements. Google Sites and Google+ Communities have served as the foundation for this model, and it has been extended to include Google Drive, Google+ Hangout and other tools.

The transition from the integrated model to the distributed model has brought with it changes in the teachers' practices. Currently, a teacher has to be present in several locations in cyberspace, and there is a need to reorganize work in order to follow what students are doing in cyberspace. In the distributed model, a teacher continuously follows students' personal and collaborative learning environments during the process of guidance and counselling, requiring the ability to work in several environments and to absorb new tools quickly. Teachers now must be able to work in the constantly changing environment of cyberspace, requiring an eagerness and willingness to continually enhance one's own competences.

However, the biggest change has occurred in how students work in cyberspace. Students have the freedom to choose tools for their personalised learning paths and for team processes. In this way, students use familiar tools that they would like to continue using afterwards. This transformation has enabled more personalized solutions and experiments that continue to exist after the programme: one challenge with our Moodle was the fact that students lost access to the LMS one or two weeks after graduation.

The transfer from the integrated model to the distributed model dismantles ownership of the learning environment (Aarreniemi-Jokipelto, 2011). In the integrated model, the university owns the LMS, but in the

distributed model, students maintain ownership. As the owner of an environment, a student can employ his/her existing environments and access the learning environment after graduation. In this way, the solution promotes lifelong learning. This freedom affects the learning process. For example, Lee and McLoughlin (2008) argue for the significance of perceived affordances, which are a function of the perceptions and views of individual learners. These researchers encourage educators to empower students with the freedom and autonomy to select and personalise the tools and technology available to them, allowing them to determine how best to use technology to support their learning. Table 1 illustrates the owners' effects on the learning environment.

Table 1: Advantages and disadvantages with different owners of learning environments and tools (adapted from Aarreniemi-Jokipelto, 2011 & 2012)

Owner of learning environment	School, educational institution, university	Teacher, facilitator	Student
Number of tools	few, limited	several	few – several
Disadvantages	teacher does not have the desired tools and functionalities	students can be confused if all teachers use different tools	teacher has to work with and learn several tools
Examples of tools used in learning	Moodle, Blackboard, Connect Pro	Google Sites, Google Drive, Google+ Community/Hangout, Blogger, Movenote	Google Sites, Google Drive, Google+ Community/Hangout, Blogger, Movenote
Advantages	All teachers use the same tools	Learning environment includes the needed functionalities from the learning point of view	Students have access to personal learning environments even after graduation Students have the freedom to use tools based on their own desires Supports lifelong learning
Access after graduation	No	No	Yes
Structure of learning environment	Integrated model	Between integrated or distributed model	Distributed model

Guidance and counselling of personalized learning process

Characteristics of learning in the web-based teacher training programme include a learner-centred approach, personalization and collaboration. The following figure illustrates the guidance and counselling actors in these processes. In addition to the facilitator, the guidance and counselling process includes various actors, such as team members in the teacher training programme and place of employment.
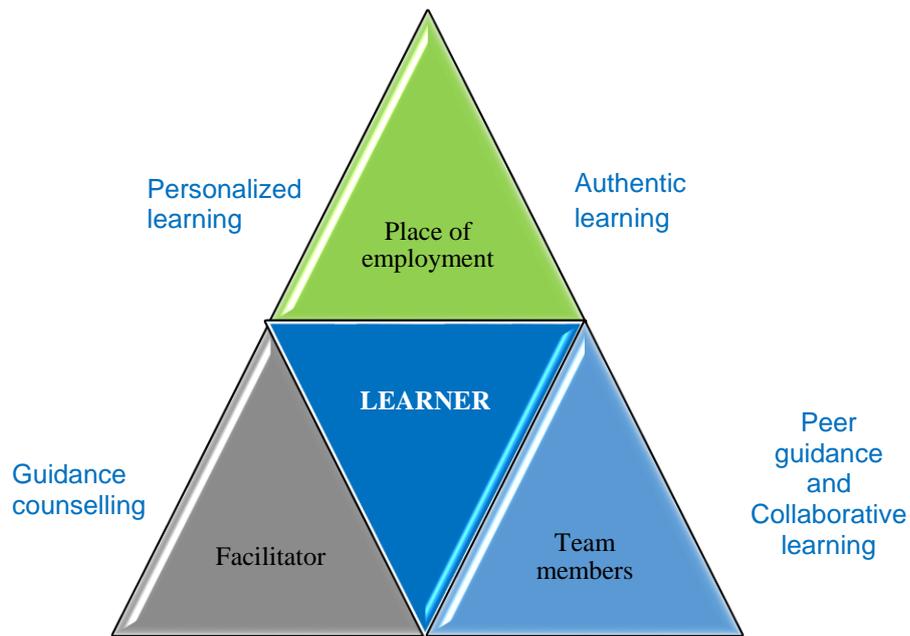
Figure 6: Guidance and counselling for the learning process.

Online guidance and counselling is extremely important, because the programme only has eight contact days during the entire year. In recent years, teachers served more as facilitators than teachers. The facilitator does not design learning processes for the students beforehand; instead, the learning processes are co-designed with each student. The university provided the curriculum, describing the teachers' competence requirements and general guidelines for studies; beyond these guidelines, each student was encouraged to define his/her learning objectives, the learning activities to achieve these learning objectives and the assessment criteria. Because the students work primarily in educational organizations, they have been encouraged to develop their work alongside their studies. Therefore, it was crucial that students use their own work as a learning context to the greatest extent possible. Each student had an online personal guidance meeting with the facilitator, creating the first version of his/her personal development plan. Prior competences were also discussed during the first guidance meeting. If a student had prior competences to be recognized, the student was asked to present them in a portfolio and have another meeting with the facilitator to present them (e.g., work examples and reflections). Figure 7 illustrates the prior competence assessment and recognition model in the web-based teacher training programme.
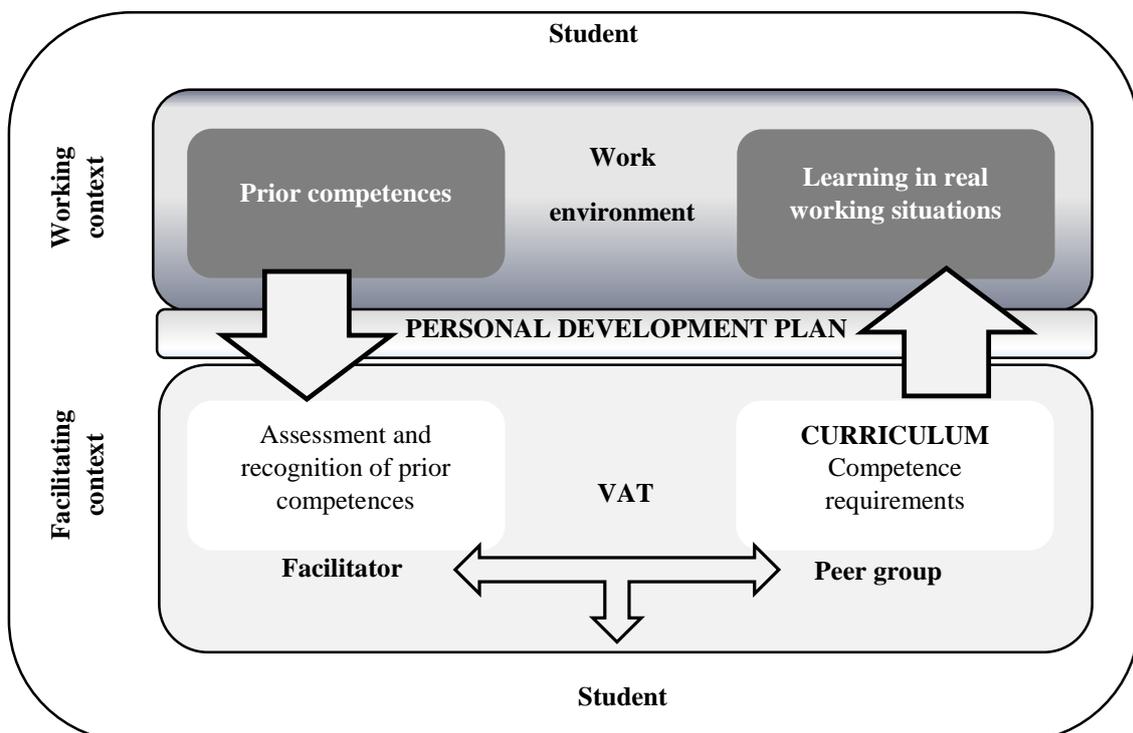
Figure 7: Prior competence assessment and recognition in the web-based teacher training (Aarreniemi-Jokipelto, 2014).

Each student has at least three annual guidance meetings with the facilitator, and the defined learning objectives are assessed during the second and third guidance meetings. If needed, it is possible to redefine and modify learning objectives. Three online guidance meetings are required, but the student can request as many guidance meetings as they like. In addition to the online meetings, the facilitator also guides the learning process through cyber space. Each student must keep an online learning diary and an online portfolio, both of which are used to guide the learning process. In addition, the facilitator also observes students teaching at work and guides the learning process there. In addition to the facilitator, other peer group members play a guidance role, an important part of the process.

In previous years, students' guidance and counselling feedback has been very positive. On a rating scale of 1 to 5, the average rating has varied from 4 to 4,7. Figure 4 illustrates students' evaluation of personal guidance and counselling in the web-based teacher training programme from 2008 to 2014.

Figure 8: Personal guidance and counselling from 2008 to 2014.

Collaborative learning space

As mentioned previously, collaboration is one of the key features in the web-based teacher training: students form peer groups consisting of three to five members. Students receive collaborative and individual assignments, but peer groups exist throughout the collaborative and individual learning situations. During the individual assignments, peers continue to converse, motivate and challenge each other in support of the knowledge creation process.

Each peer group creates its own collaborative learning space, which is utilized online. A collaborative learning space refers to a cyberspace allowing a peer group to interact, generate ideas, share knowledge and experiences, construct knowledge, provide social support, motivate each other and provide peer assessment. These cyberspaces consist of several social media tools that enable collaborative activities during studies. Each peer group owns their respective learning space; thus, it is organised, customized and created collaboratively. As a result, the final tool combination varies from peer group to peer group. These groups also decide if the collaborative learning space is open or closed to outsiders, but the instructor is always invited to the collaborative learning space.

The peer group also defines the rules of how to study together and how to use the collaborative learning space. Because students have collaborative assignments, they create team action plans in which they

define learning objectives, learning situations and rules. The learning outcomes are assessed in collaboration with the facilitator and peer group members.

According to students, the collaborative learning space and peer groups have increased motivation because peer support has been exceptionally strong. Many students have stated that without peer support, it would be impossible to graduate in a year. Peers provide energy in challenging situations, and when the message comes from a peer, it has a different effect than when it comes from a facilitator.

Collaborative online assignments and activities: reflective space, literature review

This chapter aims to describe some of the collaborative assignments and learning activities. In particular, it focuses on the reflective space and literature review used in the programme. The reflective space is one of the assessment methods used for collaborative assignments. Researchers view the reflective space as a place where understandings emerge from the complex situations that occur during studies (Aarreniemi-Jokipelto & Alanko-Turunen, 2011). At the beginning of the reflective space, facilitators produced two podcasts: the first one included overall feedback on the assignment and the other invited students into a reflective space. In the invitation podcast, the students are invited to produce a comprehensive learning story of their learning process at the end of a large collaborative assignment, and they are encouraged to identify the key features of their learning experiences. Students are invited to examine the emotions related to their learning while attempting to understand how learning has affected them and how they themselves have been affected by their learning. The process consists of four phases. First, the students are asked to reflect on their individual experiences in the learning process. Second, students present their reflections to the peer group. Third, the students have a reflective dialogue with a set of questions designed to clarify understandings and learning outcomes. Fourth, students are invited to produce a comprehensive learning story to be podcasted. According to feedback from students and teachers' experiences, the reflective space concept has been a positive solution because it generates information that would not otherwise be acquired during the learning process.

In this programme, the literature review is a collaborative assignment in an online context. After a peer group defines their learning objectives in a competence area, they define three research questions they are planning to solve in the literature review. Next, the peer group chooses the literature from a list included in the curriculum, but students can also negotiate with a facilitator about other options if they feel that a particular viewpoint or topic is missing. After choosing the literature, the peer group makes decisions about who will read which books and articles. While reading, the students are to look for answers or solutions to the research questions and produce an abstract about a book or an article. The abstract is not a short version of the book or article; rather, it aims to answer the research questions and adds questions that the reader would like to discuss with other peer members. The students may choose the form of the abstract, but usually, they follow either text formats shared online or audio recordings. To prepare for the online meeting, each group member reads or listens to the abstract. Peer groups normally hold a Google Hangout or Skype meeting to converse about the books and articles. In practice, there tend to be several online meetings during the process. The rationale behind this literature review process is to share peer members' own experiences with the topics while also disseminating knowledge obtained from the literature. Because the peer groups generally include students with different backgrounds, the literature review discussions have been fruitful and useful.

Discussion and conclusion

When examining the number of applicants to the web-based teacher training programme, it becomes apparent that there is a need for this type of teacher training programme. The number of applicants has risen by 173 percent over the last two years, with particular increases in the evening and weekend programme. Indeed, there seems to be a need for flexible solutions that do not require an extensive number of contact days. Based on students' feedback on the programme, we can state that students value the programme. In recent years, the overall rating for the programme has been approximately 4,25 on a scale of 1 to 5. Feedback on guidance and counselling and in other categories has also been very positive.

The web-based teacher training programme has undergone a long development process beginning with the paper prototype in 2007. The move away from the LMS to using free software and a combination of tools has entailed major pedagogical changes, larger than the technical changes themselves. We have moved away from the integrated model to the distributed model, a transformation that better supports the learner-centred approach we had in mind. The more visual and diverse forms of instruction and materials have engaged students more than previous models. At the same time, students are taking on an increasingly major role as producers of materials instead of the teachers. The teacher's role has become facilitating the learning process. The most important models of the programme are the recognition of prior competences, the personalized learning paths and the collaborative learning space models. These aspects of our programme have provided more flexibility to students while meeting the requirements of our current digitalized society.

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