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Identifying Vocational Student Teachers' Competence Using an ePortfolio

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Abstract

The claim of advancing the use of Personal Learning Environments arose from the ideas of an ongoing learning process which lasts throughout a lifetime and informal learning being a meaningful part of the development of an individual's expertise. In order to develop expertise, the following steps are necessary: first, one must explore the competences related to the profession; second, one must discover what these competencies and skills involve; and third, one must reflect on how to master the techniques involved. In addition to this kind of individual process, it is also important nowadays to acknowledge that demonstrating that one has achieved the necessary competences is important information for many audiences, such as workplaces, networks and employers. Nowadays, the most effective way to show one's competence to a wider audience, as well as to review one's skills oneself, is to create a digital record or portfolio (an ePortfolio). However, making an individual's competence transparent in a digital format has proven complicated. This study focuses on exploring vocational student teachers' competence through their ePortfolios, mainly using a theoretical framework of the pedagogical infrastructure design. The study reveals that there is a lot of variation in the quality of ePortfolios and therefore more scaffolding is needed to support student teachers in making their teacher competence visible through ePortfolios. The study advocates both creating a workspace ePortfolio as well as making competence transparent through a showcase ePortfolio.

Keywords: ePortfolio, personal learning environment, teacher competence, scaffolding, VET

Introduction

Personal Learning Environments (PLEs) are increasingly being used in the context of personal development for individual purposes of learning activities and are also expanding outside formal education contexts (Fiedler and Väljataga 2013). Professions are combined with many different competencies, and formal education is not the only way to develop the competence needed in modern professional life. Therefore, it is essential to consider how competence is made transparent and visible in order to demonstrate it to different audiences. One method of accomplishing this is to use a personal portfolio; when a portfolio is assembled in a digital format it is called an ePortfolio.

Neither portfolios nor ePortfolios are new concepts. They have been widely studied from different perspectives, including professional learning design, development planning (Daunert and Price 2014), and technology (Milman and Kilbane 2005). Previous studies have explored ePortfolios as a reflective tool which is seen an essential part of a learning process (Kankaanranta, Grant, and Linnakylä 2007); they are also often understood to serve as a learning diary (Kankaanranta 2007; Viksted 2007; Awouters, Bongaerts and Schrooten 2007). Furthermore, ePortfolios have been studied as a possible means of learning by doing, in other words, the creation of an ePortfolio may be used as a learning process which encompasses ownership, reciprocity, dialogic reflection and focusing on the learning journey (Hughes 2010). However, ePortfolios are not just for learning. Cambridge (2008) wrote that the audience for ePortfolios might be career advisors, employers, personal associations, family members, communities and portfolio owners themselves. He continued that portfolios are used not only for a lifetime learning process generally, but in particular to increase employability. It is meaningful to job-seekers' competence to prospective employers through an ePortfolio, but the ability to create an ePortfolio can be understood as a skill in itself. By representing their skills in an ePortfolio, individuals may better understand not only their professional development but also their needs for further development in the future, as they help narrow the boundaries between education and work (Korhonen et al. 2007). Korhonen et al. (2007) indicated in their study that the most significant issue with portfolios seems to be the integration of formal and informal learning. Reflective writings and tangible artefacts demonstrate an understanding of experiences and tacit knowledge. This study draws on Hughes' (2010) study of using ePortfolios in a learning process which enables learning through making an ePortfolio by focusing on the learning journey and Cambridge's (2008) study of different audiences of ePortfolios to whom competence are shown.

To date, most research on ePortfolios has focused on learning and teacher education; few studies have examined how they make teachers' competence transparent. Teachers' competence is often defined by and based on Shulman's (1986; 1987) studies, which investigated knowledge-based teaching with pedagogical actions. According to Toom (2017, 806), teachers' competencies are nowadays often defined as student teachers' learning outcomes in the teacher education context. She continued that competencies cannot be learned only through formal teacher education—from a longer perspective they must also be acquired in practice in a teaching career. This highlights the need for scaffolding students' professional development so that they continue after one's studies are completed, for example, through maintaining an ePortfolio. Growing competence should also be transparently represented in ePortfolios which explicate a teacher's skills. Wenström, Uusiautti and Määttä (2018) suggested that teachers developing their own expertise in the field of vocational education and training must consider the competence(s) required, explore their existing competences and reflect on how to obtain the required competence(s). According to Wenström et al., (2018) vocational teachers are very enthusiastic when it comes to developing their careers and expanding their work responsibilities. With regard to improving one's performance in the workplace, this requires readiness to engage in professional development continuously throughout one's entire career (Uusiautti 2016). To be able to perceive one's own competence requires making it transparent and visible to oneself as well as to a wider audience. This study explores and suggests how ePortfolios can be harnessed for this purpose.

This study focuses on vocational student teachers' competence presented through their ePortfolios after participating in a vocational teacher education program (60 ECTS). The participants studied for the qualification of vocational teacher in a blended learning program which lasted one and a half years. The curriculum of the vocational teacher education program included vocational pedagogy aspects

such as pedagogical models, teaching methods, learning design, scaffolding, work-based learning, teachers' networking, communication and dialogical skills, digital skills and teaching practices. The study utilized different definitions of teachers' competence to evaluate what kinds of competencies were demonstrated through student teachers' ePortfolios and how they were explicated.

Previous research about ePortfolios

As Hughes (2015) wrote, there is a lot of potential in using ePortfolios in teacher education to demonstrate retention and achievement. According to her study, ePortfolio-based learning supports students' confidence in theoretical studies and in workplace training. According to Struyven, Blieck and De Roeck (2014), in the context of competence-based teacher education, the portfolio has been enhanced as a potential tool for the development and assessment of teaching competencies. In addition, Rico (2017) argued that ePortfolios should be organized around competencies. However, a successful use of ePortfolios in teacher education for learning purposes requires that the ePortfolio process be intentionally integrated in a curriculum design (Lewis 2017). It needs to be framed in a training program in order to attract the needed attention (Imhof and Picard 2009; Rico 2017). In creating and maintaining an ePortfolio a student teacher may achieve an understanding of the competence and practices of the teaching profession; conversely, these skills may also be apparent to others in a teacher's ePortfolio (Berrill and Addison 2010). The criteria for ePortfolios lies in showing individuals' competencies for progressing and planning their career (Lumsden, Meyer, and Garis 2007).

Barrett (2010) stated that an ePortfolio is a collection of evidence which represents a person's learning journey over time. She explained that ePortfolios must be created in two phases. First, students create their own workspace where they can create and save artefacts and important learning materials. Workspaces are not usually directly sufficient to show their owners' competence for wider or public audience and are therefore used as a repository. Second, these repositories are needed when students start organizing their materials and artefacts into a showcase which presents their competence in an edited format to wider audience and even publicly online. As Barret (2010) explained, ePortfolios provide a means of storage (collection), process (collection and reflection), and product (selection/reflection, direction, and presentation). She also pointed out that some of the artefacts may be the same in all levels or they may be edited during levels and stages. Documents of artefacts which present learning outcomes could be attached to reflect what should be ongoing learning processes, not indications of the end of a process (Barret 2010). However, evaluation as a summative assessment of learning needed as the end product of portfolio—that is a showcase (Barret 2010).

In some recent studies, ePortfolios were assessed and explained using certain software designed for official use by an educational institute (Le 2012; Oakley, Pegrum, and Johnston 2013). According to several studies related to the philosophy of Personal Learning Environments (Wheeler 2015, 119; Vuojärvi 2013; Fiedler 2013), ePortfolios need to be chosen by students themselves as a tool to enable a life-long learning process and to promote ownership.

Modern ePortfolios benefit from an appealing visual appearance. It is possible to present material as a combination of text, pictures, photos, videos, figures and so forth, to make individuals' competence transparent in a multifaceted way. Multimodal artefacts and materials are popular nowadays in all kinds of learning processes. Multimodal refers to presenting different means of meaning-making together, such as words with photos, figures with video, and so forth (Jewitt, Bezemer, and O'Halloran 2016). Multimodal portfolios are a natural development for ePortfolios. Because there are a number of web tools which can be used for content creation and sharing and there are discipline-specific differences in the ways in which competence can be made visible, the personal learning environments and ePortfolios are always unique. ePortfolios are a good platform to demonstrate competence. Vocational teachers' competence in the teaching profession is described in the following chapter.

Framing the competence of vocational student teachers

Teaching in vocational education is significant because it contributes to the welfare, maintenance and progress of society (Grollmann 2008). According to Grollmann (2008), specific knowledge is required from vocational teachers which relates to technological developments and the knowledge of specific production processes in professional contexts. Vocational education is often defined as a complex combination of pedagogical content knowledge and teaching actions, substantive competence and situational accomplishment (Oser, Salzmann, and Heinzer 2009). However, Köpsén (2014) stated that the identity of vocational teachers lies in guiding students towards social practices and membership of the society. It seems that there is no general definition of vocational teachers' competence, and therefore in this chapter an overview of teachers' competence in general is presented which also applies to the profession of vocational teaching.

Teachers' competence is a complex combination of knowledge and skills (Toom 2017). Shulman (1986) described the forms of teachers' content knowledge as falling into three categories: a) subject matter content knowledge; b) pedagogical content knowledge; and c) curricular knowledge. Subject matter requires not only an understanding of a subject but also why it is important to students. Pedagogical content knowledge relates to the ability to teach in a comprehensible way which makes it easy to learn a topic—this includes understanding learners' backgrounds, such as group details, individual needs, learning outcomes and values (Shulman 1986). Curriculum knowledge includes the full range of programs designed for teaching, along with instructional materials related to the subject (Shulman 1987). Toom (2017) defined teachers' competence at a general level in four dimensions: theoretical challenges; know-how; practical challenges; and "know-that". According to Toom (2017), teachers' competence should also include general knowledge of theories, educational instructional processes, subject matter, the ability to utilize theories to perceive and structure instructional phenomena, knowledge of pedagogical methods and the ability to apply pedagogical methods and solve problems.

There are several categorizations of teacher competence for the twenty-first century, including technological modernization and globalization (Kerluik et al. 2013). Studies of teachers' digital competence agree that pedagogical skills should be included in discussions of teachers' digital competence (Krumsvik 2014; Tammaro and D'Alessio 2016.). Based on a review study, Ilomäki et al. (2016) stated that there is no overall consensus of the definition of digital competence, but there is a need to find a common ground for using the same concept by different users in educational contexts. They defined digital competence in general as consisting of four elements: (a) technical skills and practices to use digital technologies; (b) the ability to use and apply digital technologies in a meaningful way for working and studying; (c) the ability to understand ethical issues relating to, limitations and challenges, and critical use of various technologies, as well as understanding computational thinking and robotics; and (d) the motivation to participate and engage in digital culture. The researchers emphasized that technology is not "a specific content to be learnt but a didactic approach to be applied" (Ilomäki et al. 2016, 671) in substance and should not be considered too narrowly.

An often-cited theory of teachers' competence is Koehler and Mishra's (2009) Technological Pedagogical Content Knowledge (TPACK) model. Koehler and Mishra (2009) defined content knowledge as subject matter to be learned, pedagogical knowledge as teachers' knowledge of teaching and learning practices, and technology knowledge as rapidly changing digital technology. However, the TPACK model does not define how technical tools are transforming content and pedagogy; neither does it take into consideration teachers' values and epistemic content (Angeli and Valanides 2009) or twenty-first century skills such as collaborating and creative and innovative thinking (Valtonen et al. 2017).

Teachers' digital competence relates to how well they can design learning settings where digital tools are integrated into pedagogical practices. Lakkala and colleagues (Lakkala et al. 2008; Lakkala et al. 2010) defined a so-called pedagogical infrastructure framework which explicates central elements

which teachers should consider, especially when designing collaborative technology-enhanced knowledge-creation pedagogies. They recommended that the central elements be technical, social, epistemological and cognitive structures which should be designed for a learning situation and practices. This framework may be used in evaluating the implementations of technology-enhanced collaborative knowledge practices in education.

When discussing the competence of vocational (student) teachers—or any teachers—managing substance knowledge (epistemological component / subject) is a central competence which cannot be separated in an assessment of pedagogical or digital competencies (Shulman 1987). However, in this study we do not explore substance competence itself; this study is focused on a vocational teacher education program which educates teachers in pedagogical competence. The student teachers are expected to have developed substance competence in their previous studies, such as their master's degree courses.

Two frameworks for evaluating student teachers' ePortfolios are used in this study. Firstly, Ilomäki et al.'s (2016) concept of digital competence was used to evaluate student teachers' digital competence. Secondly, Lakkala et al.'s (2010) pedagogical infrastructure framework was implemented to evaluate student teachers' pedagogical competence.

Aim and research questions

One of the aims of this study was that it explains how vocational students describe their teachers' competence through learning assignments included in their teacher education program. The research was conducted in order to improve the use of ePortfolios in the study process and in presenting one's own competence in a digital format.

This study investigates the pedagogical and technical competence of vocational student teachers by exploring their ePortfolios. In the study program examined, using ePortfolios was a new method for reflection practices and collaborative learning processes, as well as being a repository designed to make individuals' competence transparent. The main aim of the study is to explore and describe the content of ePortfolios of student teachers. In addition, the study investigates how student teachers' competencies are made visible in different forms, such as written texts, photos, figures or videos in their ePortfolios. The research questions are as follows:

1. What kind of artefacts and sections are the ePortfolios composed of?

2. What kind of competence is visible through student teachers' ePortfolios?

    2a. What kind of digital quality ePortfolios represent?

    2b. What kind of content quality ePortfolios represent?

Methodology

Context of the study

In the country under study, vocational education and training consists of three different qualifications: vocational upper secondary qualification, further vocational qualification and specialist vocational qualification. Teachers of these qualifications are advanced professionals in their own disciplines and must continue with vocational teacher studies to have a permanent position in vocational institutes. The vocational teacher studies are also targeted to teachers in universities of applied sciences. Professional teacher studies include 60 ECTS and it takes usually from one to one and a half years to complete them. Most of these students must study part-time as they are already working as teachers or in other positions in educational organizations, or in different professions and positions in companies.

Setting

The study was conducted with two professional student teacher groups in academic years 2013-2014 and 2014-2015. The groups worked in a blended learning setting. The tasks assigned during the study focused on authentic work situations in educational institutes.

During the studies, the lecturer used a digital platform to share learning materials, to assign learning tasks and to scaffold the whole study group. With the first group, the lecturer used a portfolio tool based on the Mahara system. With the second group the teacher used the learning management system (LMS) Moodle. Student teachers were allowed to choose their own ePortfolio platform following a training session about existing digital tools in one of the courses. This pedagogical approach supports the philosophy of Personal Learning Environments in learning processes.

The lecturer instructed the students to produce the following content for their ePortfolios: a learning diary, a project work report, a learning design plan and artefacts. It was also suggested that they produce a personal development plan to include in their ePortfolio. In addition, the participants were guided to include any other important artefacts or materials in their ePortfolios according to their own needs and will.

The lecturer instructed the students to provide artefacts that included text, pictures, figures and even videos as evidence of their competence. During the practical teacher training period, the participants created a very detailed plan of teaching and scaffolding (a learning design) for a chosen educational setting and implemented their plan in practice while completing their teacher training practise. In the end of the studies students made a project related to the development of pedagogical practices or system level development in an education organization and reported it. Digital tools were both an objective, as part of learning to create an ePortfolio, and a way to demonstrate one's own competence through ePortfolio. The lecturer provided technological as well as substance scaffolding.

The Participants

The first group consisted of 8 female and 12 male participants, whose ages varied between 34 and 55 years. The second group consisted of 10 female and 8 male student teachers who were from 34 to 57 years old. The participants represented all disciplines of vocational education, from upper secondary vocational education and training to instructors at universities of applied sciences. For upper secondary vocational education and training, the following disciplines were represented: ICT, Security, Carpentry, Business and Management, Electrical Engineering, Agriculture, Multicultural Studies (for immigrant students), Hairdressing, Logistics, Tourism, Early Childhood Education and Chemistry. The participants who represented universities of Applied Sciences were from disciplines such as ICT, Welfare and Health (dental hygienists, health clinic practitioners, etc), Prison Officers, Automation Engineers (and other engineering programs), Mathematics and Biotechnology.

Data collection

Because the focus of this study is on what kind of competence is shown in ePortfolios, only the material included in the ePortfolios of the participants was used as data. Thirty-six ePortfolios were analysed in total. The participants were informed of the research details, that their participation was voluntary and did not influence the assessment of their performance in the study program. They were also informed that they could leave the study whenever they wanted and that after the study was completed it would be possible to remove reading rights of their ePortfolio from the lecturer (who was also the researcher of this study).

The data (the ePortfolios) were saved and shared with the researcher online based on the tools the participants used, such as the Mahara portfolio tool and social media blog platforms such as Wordpress and Blogger.

Data analysis

The study was conducted using abductive analysis, a process of gathering observations, reading theories extensively, working with observation data and active inquiry combining theory-informed and data-grounded approaches (Tavory & Timmerman, 2014). The first author conducted the analyses, which were then examined and revised several times together with the other two other authors. All three authors agreed on the final categorization.

The study included four phases of analyses: (a) artefacts and sections indicating a general structure of ePortfolios; (b) technical implementation of ePortfolios indicating digital competence; (c) Analysis of learning designs indicating pedagogical competence; and (d) analysis of project work reports indicating pedagogical competence. To answer research question 1, all ePortfolios were first analysed by counting the number of artefacts included a digital format. Artefacts were divided into two categories: single-modal artefacts and multimodal artefacts. Single-modal artefacts include text, photos, figures, video, tables or even links to other online objects and sites. Multimodal artefacts are composed of two or more single-modal artefacts. The analyses were continued by exploring what content sections the participants had included in their ePortfolios. All notable sections of the ePortfolios were listed in an Excel file. Each ePortfolio included one or more sections. All produced artefacts were studied, and it was noticed that learning designs and project work reports had the richest content. Therefore, to answer research question 2, they were chosen to be analysed in a more detailed way.

The quality of participants' digital competence was assessed by studying the way they had used digital tools to create their ePortfolio. This analysis was used to answer research question 2a. The ePortfolios were examined several times and preliminary findings were coded in an Excel file. Three different levels of using digital tools for creating an ePortfolio were found: (a) a minimum level with only a few digital functions of an ePortfolio tool used (Ilomäki et al. [2016], element 1); (b) an average level with digital tools used in a few different ways to build an ePortfolio, such as embedding multimedia, blog, and rss feeds (Ilomäki et al. [2016], elements 1 and 2); and (c) advanced level with several completed multimodal artefacts (Ilomäki et al. [2016], elements 1-4). The definition and elements of digital competence by Ilomäki et al. (2016) were then applied to categorize the findings. Element 1 was seen as the skill to use digital technologies, element 2 as the ability to use and apply digital technologies in a meaningful way, element 3 as the ability to understand the phenomena of digital technologies (such as computational thinking), and element 4 as the motivation to participate and engage in digital culture.

In order to answer research question 2b regarding the content quality of ePortfolios, the learning designs were evaluated based on the framework of pedagogical infrastructure (Lakkala et al. 2010), which includes four components: technical, social, epistemological and cognitive. The participants' pedagogical competence was evaluated by examining how they had created a learning design which took these components into account. A learning design is a detailed plan for building a learning setting for participating students. The technical component was defined as providing appropriate technology as well as technical advice to participants through the learning process; the social component included the nature and combination of individual and collaborative activities designed in the learning tasks; the epistemological component explained the ways of operating with and processing knowledge through the nature of learning assignments; and the cognitive component included the learning assignments which promote students' self-regulative and metacognitive competencies in work.

According to Lakkala et al. (2010), the pedagogical infrastructure framework is helpful in designing support structures in educational settings, but at the same time it takes into account that situations vary and each case depends on the learning goals and intended activities. They also explained that this framework could be used to classify and analyse the pedagogical elements in various educational designs and settings. In the present study, the categories were used to analyse the participants' learning designs in the following ways. The technical component included mentions of both physical and digital learning environments or working spaces. The level was evaluated based on how many different kinds of environments participants mentioned in their learning designs. The social component was evaluated from the descriptions of learning assignments and the levels were defined

based on how individual or collaborative the learning assignments were. The descriptions of learning assignments were also the basis of assessing the epistemological component. The levels were defined based on whether the assignments related mainly to theoretical knowledge, authentic work-related knowledge or creating new knowledge. The cognitive component was also evaluated based on the nature of learning assignments using the following categories: (a) only one type of cognitive support was mentioned; (b) two types of cognitive support were mentioned; or (c) three types of cognitive support were mentioned. The support types were: (a) learning objectives were explained or personalized to students; (b) self-directed learning activities were supported; and (c) self-reflection, self-assessment and/or peer-assessment guided. The cognitive component was also separately assessed according to the ways of scaffolding and feedback mentioned in the learning design. The levels of scaffolding and feedback found in the designs were from light descriptions to constant activities. The exact levels of each component are explained in Table 1.

Table1. Criteria for evaluating the learning designs

Level	Technical component (physical and digital learning environments	Social component (features of learning assignments)	Epistemological component (features of learning assignments)	Cognitive component (1-3 types of support features mentioned in learning assignments)	Cognitive component (scaffolding and feedback)
1	one environment (e.g. classroom and/or laboratory OR one LMS)	only individual or in pairs	repetitive, theoretical considerations	learning objectives explained / scaffolded / personalized to students	very light descriptions
2	several environments: physical (1 or more) AND digital	some collaborative	partly applied, authentic	activities to support self-directed learning	feedback and/or assessment in the end or in the middle
3	several environments and digital tools used in several types of tasks	several and different kinds of collaborative	creating new knowledge	self-reflections and self-assessment and/or peer-assessment	constant

In total each learning design received a score from 1 to 15.

The project work report was a way to evaluate participants' competence in an aspect of practical educational development work in educational institutions as one part of a pedagogical competence. It was used to answer research question 2b regarding pedagogical content quality by analysing the project work reports, which were evaluated by investigating their content and categorizing it as one of the quality levels presented in Table 2 below. The criteria are based on the lecturer's instructions for a project work report. The project work reports were expected to be theory-oriented where theories are applied in practical experiments and had to include a reflection on the conducted experiment.

Table 2. Criteria for evaluating project work reports

Level	Theory	Experiment	Reflection
1	fragmented	loose examples not related to theory	loose or missing
2	partly relevant, partly fragmented	loose examples, but theory oriented	short comments about theory/experiment
3	well structured, relevant	research question/problem defined, practical experiment	experiment reflected theoretically, lessons learned, suggestions for future actions

Finally, all scores for each ePortfolio were calculated. The total scores were as follows:

- Digital level 1–3
- Learning design 1–15
- Project work report 1–9
- The maximum score was 27.

Results

The artefacts and sections of the ePortfolios

The results presented in this chapter answer research question 1 relating to artefacts and sections. A total of 208 single-modal artefacts were found in all ePortfolios. In addition, there were 39 multimodal artefacts that included 120 single-modal artefacts. The numbers of all types of artefacts are introduced in Table 3. The most frequent way to include an artefact in an ePortfolio was an attached appendix in the form of text, created using a word processing application such as Microsoft Word. The second-most-used format was text pages created using an ePortfolio tool. Much less popular formats were text-based artefacts with tables embedded in the ePortfolio and links to objects and sites outside the ePortfolio. Graphic artefacts like photos and videos were present in only a very few ePortfolios.

Table 3. Artefacts created with different web tools

	Single-modal artefact (made with one digital tool)	Single-modal artefacts included in 39 Multimodal artefacts
Text pages created using an ePortfolio web tool	66	34
Text document included as an appendix	72	10
Tables	26	15
Figures	1	25
Photos related to text	11	13
Irrelevant photos	0	10
Videos	2	2
Links outside of the ePortfolio	30	16
Total	208	120

Sections included in the ePortfolios were a learning diary, a project work report, artefacts, a learning design, a personal development plan, a profile and learning materials. One or more sections were found in each of the 36 ePortfolios analysed. The numbers of each type of section found are presented in Figure 1.

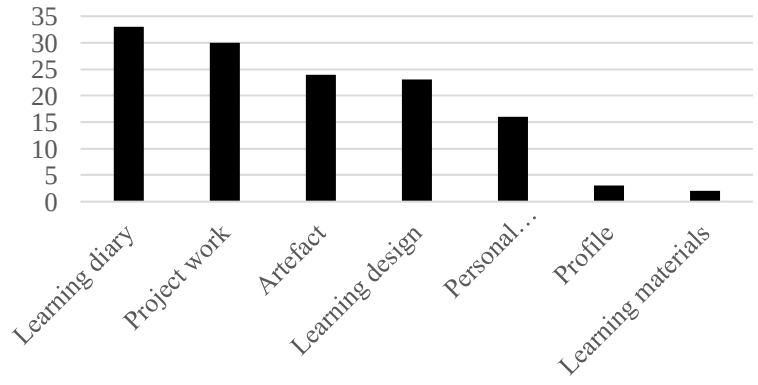

Figure 1. Sections of the portfolios.

The digital quality of the ePortfolios

Research question 2a was answered using the results of how participants used digital tools to create ePortfolios. The use of digital tools to create ePortfolios was categorized into three quality levels. Twenty-one of the 36 portfolios received the lowest score: In these ePortfolios participants used only appendixes which were Word documents or text created using the ePortfolio tool. In 15 ePortfolios the participants used other digital tools and techniques such as like embedded multimedia and blog and rss feeds from outside the ePortfolio as evidence of their ability to integrate information. There was evidence of the highest level of digital competence in seven ePortfolios, demonstrated through the use of multimedia and blog and rss feeds in several ways, which was considered to express a motivation to participate in digital culture.

The quality of ePortfolio content

Research question 2b was answered by analysing the learning designs and project work reports. Of the 36 ePortfolios, 27 featured a learning design to be evaluated, although not all of the designs included all of the expected components. The number of learning designs for each score is presented in Figure 2.

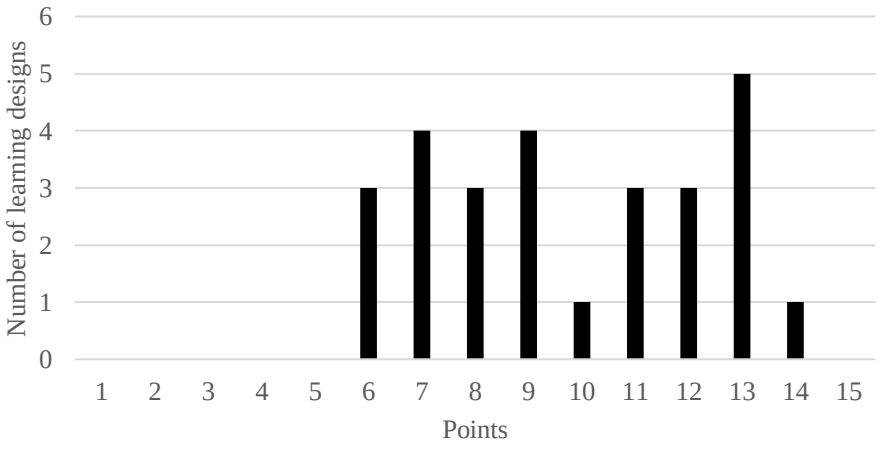

Figure 2. The number of learning designs for each score.

All of the learning designs received scores between 6 and 14, with both the mean and median score being 9. The number of learning designs in each sub-category level of the analysis framework is presented in Table 4. Not all of the components were mentioned in every learning design: Table 4 also indicates the total number of ePortfolios which included them.

Table 4. Number of each component in the three levels

Level	Technical component	Social component	Epistemological component	Cognitive component (support features)	Cognitive component (level of scaffolding)
1	11	11	5	8	3
2	10	4	18	8	3
3	4	12	4	0	19
Total	27	27	27	18	26

It is necessary to consider the fact that 10 of the 36 ePortfolios investigated did not include any kind of learning design.

Project work reports were included in 30 of the 36 examined ePortfolios. The scores received by the project work reports were between 3 and 9. The mean score was 6.6 and the median was 6. The score and number of project work reports are presented in Figure 3.

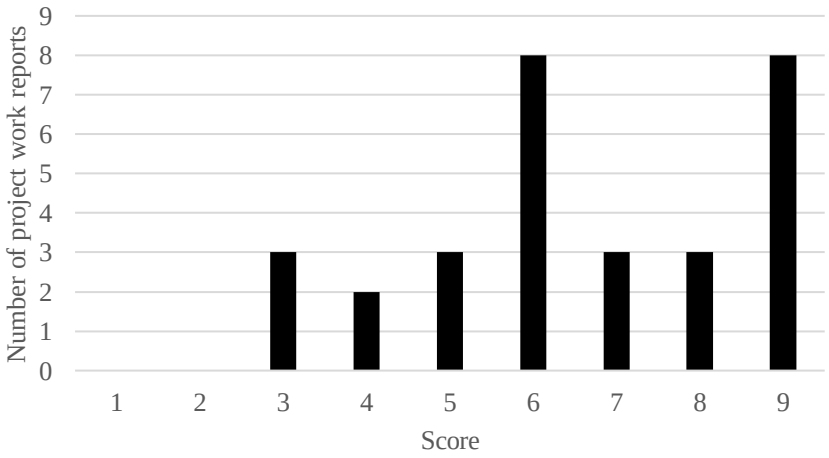

Figure 3. The results of the analysis of project work reports.

Finally, the total score of ePortfolios are presented in Figure 4.

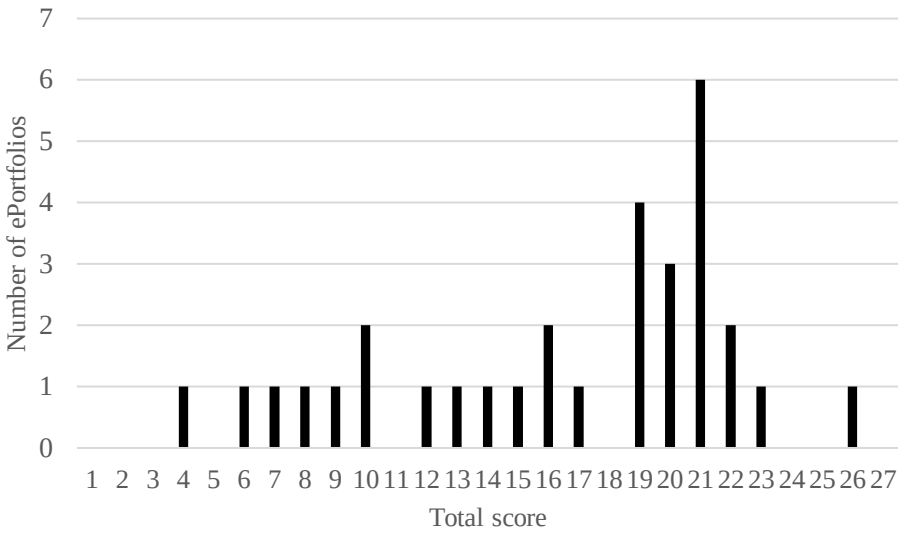

Figure 4. The total score of ePortfolios.

Three ePortfolios were chosen to be presented as examples: (a) the ePortfolio which received the highest score; (b) the ePortfolio from the middle of the range; and (c) the ePortfolio which received a low score but included several artefacts. The cases are described by analyse phases as follows:

The highest-scoring ePortfolio (26 points):

The points were divided in the following way: (a) artefacts and sections indicating a general structure of ePortfolios; (b) the technical implementation of ePortfolios indicating digital competence (3 points); (c) analysing learning designs indicating pedagogical competence (14 points); and (c) analysing project work reports indicating pedagogical competence (9 points).

This participant used the Mahara platform tool to construct an ePortfolio which included a learning diary, project work report, learning design, personal development plan, artefacts and profile information. It comprised several pages which were into sections. From a technical perspective it was constructed using multiple tools and methods, including an embedded blog tool which was used to write a learning diary, a text tool, tables and figures, and profile information in the form of external feeds from two different blogs run by the participant (one professional and one personal). This ePortfolio also included a total of five artefacts, four of which were multimodal: These were created using several web tools, such as combinations of text, photos, figures and tables (11 individual artefacts in total). The learning design represented an advanced product, as it scored 14 points out of 15. The participant included several online applications such as Adobe Connect for online lectures and online collaborative assignments in the learning design. The LMS was used in several learning assignments both individually and collaboratively. Various types of learning assignments, from individual essays to collaborative presentations to peers and to an external client from a company, were mentioned in the learning design. There was also a description of a project where the participant's students evaluated a client's specific practices and created and suggested new processes to the client in order to improve their practices. According to the learning design, the participant explained learning objectives for students and scaffolded activities to supported students in being self-directed. According to the learning design, the assessment and scaffolding of the learning process was constant, as the participant planned to make sure that all groups proceeded with their assignments. The

participant's plan was to conduct an assessment after each learning assignment. The project was related to an online learning process. The participant tested a pedagogical model with students and collected data by interviewing students and by administering a questionnaire. The data were used to answer the research questions, draw conclusions and reflect on lessons learned.

The mid-range ePortfolio (15 points):

Points were divided as follows: (a) artefacts and sections indicating the general structure of an ePortfolio; (b) technical implementation of ePortfolios indicating digital competence (1 point); (c) analysing learning designs indicating pedagogical competence (8 points); and (d) analysing project work reports indicating pedagogical competence (6 points).

The use of digital tools to construct an ePortfolio was considered fundamental to this level. In this category, participant used just two tools to create the ePortfolio: Mahara, to write a learning diary (section), and Blogger presenting other artefacts. The sections linked via Blogger were the project work report, the learning design and some artefacts. Blogger was used only to display text which had been created in Microsoft Word and then copied and pasted. Such text was not edited (e.g. lines and spaces were not fixed). There were no pictures or other visual materials included. The selected ePortfolio included 7 artefacts, none of which was multimodal. According to the learning design, teaching was conducted in a classroom and in LMS. The learning design included descriptions of group assignments as well as individual assignments which required the students to interview professionals in their authentic work situations and made reflections incorporating theory. No self- or peer-assessment tasks were mentioned in the learning design, nor were there any scaffolding activities. The assessment process was described as being in the end of the learning process and comprising an examination. For the project the participant chose a theoretical framework and tested it in practice; she described the theory and practical testing well in her report but neglected to include any reflections.

The lowest scoring ePortfolio (8 points):

Points were divided in the following way: (a) artefacts and sections indicating the general structure of the ePortfolio; (b) technical implementation of ePortfolios indicating digital competence (2 points); (c) analysis of learning designs indicating pedagogical competence (0 points); and (d) analysis of project work reports indicating pedagogical competence (6 points).

The participant used Blogger as the ePortfolio tool. The navigation structure of the ePortfolio followed the structure of the themes of the teacher education program curriculum; however, nearly all of the links the participant used went to objects and pages outside of the ePortfolio—only the learning diary was written with the ePortfolio tool itself. The links led to Google Drive documents which used a text tool. The sections of the ePortfolio included the learning diary, the project work report, and some artefacts. The ePortfolio comprised seven pages, each of which featured a very brief description with links to external sites. In total there were 22 links to sites outside of the ePortfolio. No learning design was presented, and while the project work report did include a theoretical framework it featured only a few loose examples from the participant's own teacher experience. The project work report received in the lowest level.

Discussion

The participants used mainly text-based formats to create their artefacts; very rarely did any of them use more up-to-date digital tools such as videos, photos, figures or tables. Nowadays the topic of digital learning environments is hotly debated in the education field, and there is a need to use modern digital tools to support learning as well as to create content in vocational education and training sector. Student teachers are therefore recommended to test new digital tools during their studies in order to have an impression how such tools may be seen by their own students. To be able to use digital tools in learning processes as well as in their own teaching practices student teachers need more education for digital tools. The results of the ePortfolio project indicate that the participating student teachers were not motivated to engage in the social aspects of digital learning culture (such as forming social groups in different online environments and forums) and they showed no interest in understanding computational thinking. These practices represent a high level of digital competence according to Ilomäki et al. (2016). Technically, the examined ePortfolios were created using several digital tools. The low level of digital competence was explained by Ilomäki et al. (2016) as relying mainly MS word documents as appendices or text written with an ePortfolio tool. According to this definition, the student teachers' ePortfolios did not reflect computational thinking no motivation to participate in digital culture. The reasons for their poor performance may be included a lack of technical skills and a lack of motivation to use time and energy in creating an ePortfolio. The participating student teachers did not seem willing to produce enough content to demonstrate their competence in their ePortfolios even if they were able to.

The sections of the examined ePortfolios addressed well the goals which were set for them related to the curriculum of vocational teacher education. The required sections, such as a learning diary, project work report, and learning design were found in at least some of the ePortfolios. However, none of the examined ePortfolios included all of the sections they were supposed to, and as a result there was content missing from many ePortfolios which should have described the competence of the student teachers. This reveals that more reasoning for creating instructed sections and content related is needed by a lecturer.

Pedagogical competence is crucial in every teacher's work activities and their competence may be highlighted in a learning design which includes a lot of information on learning activities and learners' backgrounds, as well as individual needs and materials related to the subject (Shulman 1987). A learning design created by a student teacher for his or her students should illustrate that teacher's competence, as these are often interpreted through described decisions. The analysis of learning designs based Lakkala et al.'s (2010) Pedagogical Infrastructure Framework revealed that the participating student teachers' pedagogical competence are better than average: Half of the learning designs scored in the highest of the three categories, and it might be said that half of the student teachers demonstrated advanced pedagogical competence by combining technical, epistemological, cognitive and social components in their pedagogical plans (learning designs). However, one-third of the participants failed to include a learning design in their portfolio, meaning that a lot of content which would have demonstrated those participants' pedagogical competence was missing. In general, student teachers participating in the study were able to apply their own professional knowledge in designing their students' lesson plans and incorporate authenticity in the learning process. They performed especially well in this regard. Student teachers' competence in understanding the importance of constant scaffolding and assessment was particularly advanced.

Most of the student teachers expressed their competence in theoretical frameworks and practical experiments well in their project work reports. They were also able to reflect on what they had learned from their experiments and how this knowledge related to theories they used. Almost all of the student teachers included their project work report in their ePortfolio. However, some of the participants needed more scaffolding to express themselves in their project work report. This kind of artefact is possible to attach directly to showcase portfolio as an evidence of ability to develop educational practices in school.

Reviewing the total scores for the ePortfolio revealed that there is a lot of variance among them. Some received very low scores, giving the impression that those student teachers may lack some of the competence necessary to work. At the same time, some ePortfolios were of high quality, indicating high level of competence as well as abilities to explore and present one's own competence creatively and innovatively. The poor quality of other ePortfolios was caused mainly by a lack of a learning design. Pedagogical competence, which was evaluated using the Pedagogical Infrastructure Framework (Lakkala et al. 2010) had the highest possible score of all evaluated sections (15 points). Therefore, the weight of the learning design in evaluating competence demonstrated by the participants through ePortfolios was high. Student teachers who had not placed their learning design in their ePortfolio had to send it via other channels, such as emailing it to the lecturer. These were not included as results in the study. In order to be certain of the level of the student teachers' competence it was necessary that they all share exactly the same investigated sections in their ePortfolios. This result indicates that more scaffolding is needed when deciding what kind of information would describe a pedagogical competence to different audiences.

The ePortfolios were left unfinished, and it seems that insufficient scaffolding was given to student teachers regarding how to create an ePortfolio which can serve as a showcase. Figure 5 illustrates Barret's (2010) vision of balancing the two faces of an ePortfolio. Barret (2010) explained that an ePortfolio has two purposes: it is first a workspace for the learning process and second a showcase which introduces its creator's competence. The process of creating an ePortfolio which was followed in the teacher education course in this study followed Barret's (2010) process of balancing the two faces of an ePortfolio by workspace dimension (marked with grey shading in Figure 5 below). The participants' ePortfolios were workspaces which, as Barret (2010) defined, are intended to be a learning process incorporating reflection and feedback as well as a collection of artefacts constructed according to a lecturer's instructions. However, the participants' ePortfolios did not serve directly as showcases for members of the wider public, such as employers. The scaffolding activities focused on the learning process, and therefore the analysed ePortfolios fulfilled the definition of a workspace. The lighter grey lines, texts, and shaded boxes in Figure 5 illustrate the missing parts of the portfolio process conducted. However, artefacts such as project work reports were in a format which could be attached in showcase portfolio without further modification. The learning designs were partly in a format which could be attached to a showcase portfolio, but most needed to be improved to be more readable and to include a conclusion with reflections first.

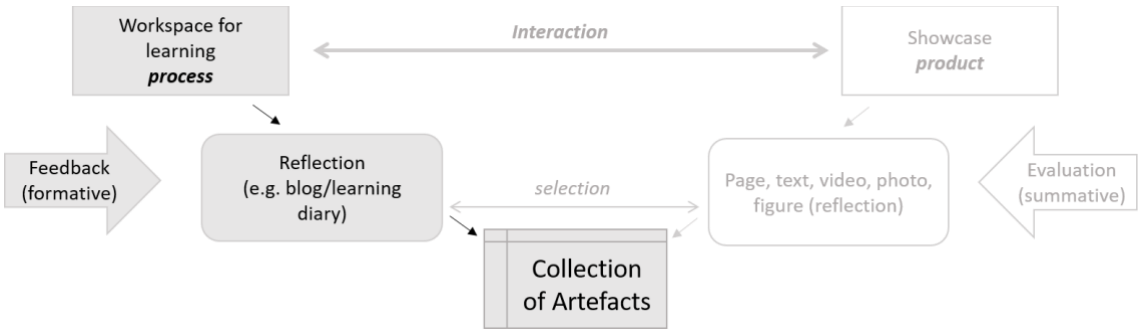

Figure 5. A workspace for the process and a showcase for the product.

Adapted from Barret's (2010) vision of balancing the two faces of ePortfolios.

Conclusions

The results of this study indicate that the scaffolding of ePortfolio processes requires a lot of effort; instructions for how students can make their competence transparent in a digital format must be designed in such a way that a wider audience can see and understand such showcases. A lecturer should plan the process of integrating a curriculum and learning design work as Lewis (2017), Imhof and Picard (2009), and Rico (2017) suggested. Such a process may be based on a theoretical framework such as those used in this study (i.e. the digital competence framework developed by Ilomäki et al. (2016) and pedagogical infrastructure framework presented by Lakkala et al. (2010). Another useful framework for scaffolding ePortfolio processes is Barret's (2010) two faces of ePortfolios (workspace and showcase).

In future research it should be noted that teaching competence cannot be learned only through formal teacher education; rather, they continue to be learned throughout a teacher's career (Toom 2017). Teachers are often willing to develop their own expertise and thereby renew their work practices (Wenström, Uusiautti, and Määttä 2018), but they need support to reach this aim. This raises the question how student teachers' scaffolding processes could be extended after they complete their formal studies in a way that they will also have an effect on their ePortfolio practices in order to demonstrate their competence whenever needed. Making one's competence transparent and visible in an ePortfolio helps one to perceive what further competences might be necessary to continue developing one's expertise to meet the needs of tomorrow's workplaces. This justifies also the use of Personal Learning Environments in learning processes with ePortfolios for ongoing learning purposes after formal education, as Fiedler (2013), Vuojärvi (2013) and Wheeler (2015) suggested.

The evaluation model developed in this study was based on previous research in order to identify student teachers' competence through ePortfolios. In the future this evaluation model can be used systematically as a tool to assess student teachers' (or any teachers') competence critical points which need scaffolding. It is also significant that it highlights student teachers' ability to use and apply digital tools in their daily work as teachers and individuals making their competence transparent in a digital platform.

In the future, it is be important to study student teachers' views on ePortfolios, as these might be relevant to identifying what aspects motivate them to use an ePortfolio in learning processes and in making their competence transparent in a showcase portfolio.

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