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“Learning Online” for Vocational Teachers - Visualisation of a Competence-Based Approach in Digital Open Badge-Driven Learning

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Abstract

Vocational education in Finland is based on competence-based qualification requirements. Meanwhile, digital open badges promote competence-based assessment and shared expertise in digital environments. The educational setting supports gamified learning solutions and enhances student motivation. The current study aims to examine how learners experience the competence-based approach in the badge-driven learning process of professional development. The theoretical framework focuses on the concept of instructional badging in the competence-based approach.

Coordinated by the country's northernmost school of profesional teacher education, "Learning Online" is a national professional development program (PDP) of digital pedagogical competences for vocational teachers in Finland. The data were collected in 2017 from in-service trained professional teachers and pre-service students (n=329) of vocational teacher education who had earned digital open badges in a Learning Online PDP. A questionnaire was used to collect both quantitative and qualitative data. The study provides an example of using two different methods to build knowledge describing participants' experiences. The study employed constrained correspondence analysis and phenomenography to analyse participants' different experiences. Both used methods highlight the badge learners' experiences and offer to deepen the existing knowledge of digital open badge-driven learning complementing one other by explaining different aspects of the phenomenon. The results describe the impact of the competence-based approach on teachers' professional development in digital open badge-driven learning.

Keywords: *competence-based approach, digital open badges, professional development, constrained correspondence analysis, phenomenography*

Ammatillisten opettajien "Oppiminen Online" – Osaamisperusteisen lähestymisen visualisointi osaamismerkein ohjautuvassa oppimisessa

Tiivistelmä

Ammatillinen koulutus perustuu Suomessa osaamisperusteisiin ammattitaitovaatimuksiin. Digitaaliset avoimet osaamismerkit mahdollistavat osaamisperusteisen arvioinnin ja asiantuntijuuden jakamisen digitaalisissa ympäristöissä. Osaamismerkein ohjautuva oppiminen tukee pelillistettyjä oppimisratkaisuja ja edistää opiskelijan motivaatiota. Tämän tutkimuksen tavoitteena on tarkastella, miten ammatilliset opettajat kokevat osaamisperusteisen osaamismerkein ohjautuvan oppimisen ammatillisessa osaamisen kehittämisessä. Teoreettinen viitekehys keskittyy oppimista ohjaavien osaamismerkkien myöntämiseen erityisesti osaamisperusteisen oppimisen kontekstissa.

"Oppiminen Online" on ammatillisille opettajille suunnattu kansallinen digipedagogisen osaamisen kehittämisohjelma, jota koordinoi maan pohjoisin opettajakorkeakoulu. Tutkimusaineisto kerättiin syksyllä 2017 ohjelmassa digitaalisia osaamismerkkejä suorittaneilta ammatillisilta opettajilta ja ammatillisen opettajankoulutuksen opiskelijoilta (n=329). Kyse-

lylomakkeella koottiin sekä määrällistä että laadullista aineistoa, tavoitteena kuvata erilaisilla tutkimusmenetelmillä osallistujien kokemuksia. Määrällinen analyysi tehtiin rajoitettuna korrespondessianalyysina, jonka lisäksi osallistujien erilaisia kokemuksia tarkasteltiin fenomenografisen tutkimusotteen avulla. Molemmat käytetyt menetelmät nostavat esiin ammatillisten opettajien erilaiset kokemukset osaamismerkein ohjautuvasta oppimisesta, ja syventävät täten olemassa olevaa käsitystä selittämällä ilmiön eri osa-alueita. Tulokset kuvaavat osaamisperusteisuuden ilmenemistä osaamismerkein ohjautuvassa ammatillisten opettajien osaamisen kehittämisessä.

Avainsanat: *osaamisperusteisuus, digitaaliset avoimet osaamismerkit, osaamisen kehittäminen, rajoitettu korrespondessianalyysi, fenomenografia*

Introduction

The emergence of the competence-based approach in professional development has reached several disciplines and educational settings. Educators and trainers across the world have recommended the adoption of competence-based education for various disciplines and curricula (c.f. Boritz & Carnaghan, 2017; Fan, 2017; Zaytseva, 2017). The competence-based approach seeks "to increase the rigour and relevance of the curriculum, move students beyond a focus on the memorisation and regurgitation of scientific facts, and better enable them to understand scientific principles and apply them to the practice" (Malone & Supri, 2012, p. 241). The concept of competence itself may be understood as an aspect of the description of human activity (Ashworth & Saxton, 1990) or as an achievement acquired through training and development (McClelland, 1973; 1998). Both approaches emphasise a descriptive interpretation of the competence, regardless of how the knowledge and skills are acquired. It has become necessary to study the competence-based approach in the current digital pedagogical framework because there is a growing demand for personalised and customised professional development responding to local challenges and unique professional needs.

Broadly speaking, e-assessment can be understood as any evaluation event that utilises a computer (Jordan, 2013). Emergent technologies provide evolving solutions to support assorted and authentic assignments through e-portfolios, games and simulations (JISC, 2010); such solutions appear not only on online learning environments but also on advanced learning management systems. As Jordan (2013, p. 99) puts it, the "blurring of the boundaries between teaching, assessment and learning" enables a design of e-assessment that evaluates and describes individual competences in a more nuanced manner than ever before. Microcredentials, such as Mozilla Open Badges, allow the competence-based recognition of excellence in smaller fractions (Davies, Randall, & West, 2015) than conventional credentialing. Digital open badges help to identify and recognise competences so that knowledge and skills become visible and useful for the work community. The competence-based approach offers the op-

portunity to draw up the competences required while aiming to support efficient identification and recognition of the skills and knowledge achieved; visualising the gap between existing and desired competences seems to help learners proceed efficiently towards intended learning outcomes and offers support for a competence-development continuum (Brauer, Korhonen, & Siklander, 2017; Hodge & Lear, 2011). The competence-based assessment process occurs on open badge management systems not originally designed to support learning activities (Brauer & Siklander, 2017). However, the process has proven successful in enhancing motivation and learning outcomes (Brauer, Siklander, & Ruhalahti, 2017). The current study aims to examine how learners experience the competence-based approach in a badge-driven learning process for professional development.

Theoretical Framework

Theoretically, this study draws on recent research into digital open badge-driven learning (Brauer, Ruhalahti, & Hallikainen, 2018; Brauer & Siklander, 2017; Brauer, Siklander, & Ruhalahti, 2017). The theoretical framework hinges on the concept of instructional badging (Ahn, Pellicone, & Butler, 2014; Gamrat, Bixler, & Raish, 2016; Reid, Paster, & Abramovich, 2015) in the context of the competence-based approach.

Instructional Badging

In its simplest form, the architecture of digital open badges consists of a graphical image, a badge name, and issuer identification data. An information-rich "skills" badge includes additional meta-data comprised of the required knowledge and expertise criteria as well as a description of the evidence required in evaluating a competence (Abramovich, Schunn, & Higashi, 2013). In addition to the instructional metadata for digital open badges, the concept of instructional badging also can be defined as an assessment process in the badge management system related to badge applications and their approval/rejection process (Brauer, Korhonen, & Siklander, 2017). Brauer and Siklander (2017) explain the instructional badging process on an open badge management system in terms of assessment and feedback provided for the learner during the badge application process. Brauer, Korhonen and Siklander (2017) found one desired realisation of online scaffolding when applying Salmon's Five Stage Scaffolding Model (2003) to digital open badge-driven learning, explaining the fourth stage of knowledge construction as the ongoing process of instructional badging. This process includes feedback, advice and scaffolding from the educators and trainers attached to the digital open badge-driven learning.

In general, information-rich digital badges and open badge management systems provide broader opportunities for learning than conventional credentialing on learning management platforms (Brauer & Siklander, 2017; Casilli & Hickey, 2016). Digital open badges are complex by nature and the design process of the badge-driven learning should be equally multifaceted to engage their full potential (Brauer, Siklander, & Ruhalahti, 2017). The heart of digital badge-driven learning is the badge application process and competence-based assessment, which involves a demonstration of the competence acquired (Brauer, Siklander, & Ru-

halahti, 2017; Reid et al., 2015). The criteria-based badge constellation provides a visual representation of layered badges, metabadges and the final badges of mastery (Brauer, Korhonen, & Siklander, 2017). The design of the constellation and families of connected badges relates to the intended learning outcomes defined in the curricula, aiming to encourage desirable behaviours by prompting and rewarding the learner for work towards required competences (Brauer et al., 2018; Brauer, Siklander, & Ruhalahti, 2017; Gamrat et al., 2016; Reid et al., 2015). Stacked and layered badges provide practical visual aids to learners (Brauer, Korhonen, & Siklander, 2017; Smith, 2015) seeking to self-evaluate existing competences and plan studies ahead; the clear and consistent badge criteria tie the learner's guidebook together, suggesting how to proceed towards intended learning outcomes (Brauer, Korhonen, & Siklander, 2017).

On a flexible study path, learners have options for customisation to meet their individual requirements for professional development and their actual needs in working life. This personalised study path for professional development may consist of selected badges from different badge families (Gamrat et al., 2016); badges may be associated with metadata, including evidence of competence in different forms (Casilli & Hickey, 2016). Further, the metadata attached explains the social context in detail (Gamrat et al., 2016) so that badge earners can collect credentials from various sources and institutions (Casilli & Hickey, 2016). In addition, personalisation and customisation should support the opportunity to produce evidence that can be introduced immediately in your own work" (Brauer, Siklander, & Ruhalahti, 2017). These predeterminations challenge the designers of badge criteria to describe the required evidence in the form of a tangible task encouraging learners to apply their acquired skills and knowledge in practise. The thorough competence-based approach suggests that learners consider the constellation of instructional badges and metabadges as "a personalised digital pathway of learning" (Brauer & Siklander, 2017, p. 192) that offers them the opportunity to visualise (Smith, 2015) and structure their studies (Ahn et al., 2014; Davies et al., 2015; Gamrat et al., 2016). This learning goes beyond the essential competences desired and moves towards lifelong learning and professional development.

Method

We adopted two very different methods for exploring the learners' different experiences in order to create a study design with a 360° view on badge-driven learning in competence-based vocational teacher education and professional development. Based on quantitative and qualitative data, the study may provide insight into using different methods to describe participants' different experiences of phenomenon. In general, multivariate methods provide a visual representation of a complex set of relationships (Borgatti, 1997). As such, we conducted a constrained correspondence analysis to analyse the quantitative data, with the expectation of describing the phenomenon. Phenomenographic approach was used to identify variation in participants' experiences.

Research Question

To view teachers' professional development on a larger scale, we need to study

their experiences and the contexts and processes of competence development accordingly (Ganser, 2000; Fielding & Schalock, 1985; Villegas-Reimers, 2003). This study sought to examine competence-based digital open badge-driven learning through the experiences of professional in-service and pre-service teachers. The key research question is as follows: how learners experience the competence-based approach in the badge-driven learning process of professional development? Further, the aim is to compare the results obtained by these two methods and increase our understanding of the phenomenon under investigation.

Context and Participants

The study context is Finnish higher education, particularly the competence-development continuum of professional teachers focusing on the identification and recognition process of digital pedagogical competencies in the professional development program (PDP) called "Learning Online". Digital open badges visualise the requisite skill sets (I-III) as the badge criteria follows national guidelines based on the UNESCO ICT competency framework for teachers (UNESCO, 2011). The participants plan and customise their personal study path and apply for competence-based digital badges by providing a required demonstration or evidence of the competence in question. Further, digital open badge-driven learning offers to facilitate the professional development process through a gamified massive open online course (MOOC) (Brauer, Siklander, & Ruhalahti, 2017). In this system, scaffolding takes place in the open badge management system, and badges serve as the simplest components of game design elements (Brauer & Siklander, 2017; Deterding, 2015).

Participants (n=329) were Finnish professional teachers and students of vocational teacher education, both men (n=77) and women (n=252) with higher education degrees from different disciplines and various working life experiences. Participants utilised the same Learning Online badges, badge management and easy-access openly-licensed learning materials (Brauer, Korhonen, & Siklander, 2017). 214 of the participants had completed the teacher's pedagogical qualifications. Nearly all participants had more than two years of experience in their professional field of work. More than a quarter of the respondents had been working for more than 20 years in their field. Their experience with digital pedagogy – measured by achieved digital open badges – ranged from less than 10 badges (n=94) to 45 (n=26). 132 of the respondents achieved the minimum requirement of 10 badges for pre-service teachers. The youngest respondents were under the age of 30, and the elders reached the age of 60. 221 respondents were working at the time of the study. Participants represented all disciplines of vocational education; most respondents came from backgrounds of social studies, healthcare and sports (n=77) as well as natural sciences (n=13). Because there were several pre-service teachers in the respondent population, almost half of the respondents lacked teaching experience.

The majority of the participants (see Table 1) represented pre-service teachers from two different schools of professional teacher education. The groups differed in that SG1 had a pre-set (compulsory) set of badges to complete; all other groups were

free to seek the badges of their choice. The second largest group of participants were in-service teachers for whom Learning Online was originally designed as a learning environment funded by the Finnish National Agency for Education. Less than 10 percent of the respondents studied in some another PDP, but completed also the Learning Online badges, which were open to anyone interested in developing digital pedagogy and vocational training. More than a fifth of the participants were self-developing their competences and did not belong to any formal reference group.

Table 1. The Participant's Reference Groups

Group	Abbreviation	N	Percent
Pre-service teacher/institution 1, fixed badges to complete	SG1	134	40,73 %
Pre-service teacher/institution 2, open badge-seeking path	SG2	64	19,45 %
In-service teachers trained by organisers of Learning Online	SG3	40	12,16 %
In-service teachers trained by another PDP funded by the Finnish National Agency for Education	SG4	11	3,34 %
In-service teachers in any other PDP	SG5	13	3,95 %
None of the above	SG6	67	20,37 %

Data

Quantitative and qualitative data were collected in the autumn of 2017 using an online questionnaire. The Finnish questionnaire was sent to all e-mail addresses (n=1246) used to apply for a badge from Learning Online from 2014-2017. Misspelled addresses and duplicates were filtered (e.g., john.smith@gmil.com was deleted and replaced with john.smith@gmail.com). In addition, the contact information of teacher trainers and tutors was removed. A total of 329 responses were received from 1100 potential participants. It is likely that some (n=1100) did not receive the questionnaire because their emails and student IDs cease to be valid after graduation. Webropol statistics showed that half (n=561) of the recipients opened the questionnaire, and 329 responded. Participants were provided with a description of the study and informed the uses that will be made of the data. Only the first author had access to the survey software tool and the personal identification data. All data were anonymised (including institutions and individuals) before analysis. The identifying information will be deleted when the study is complete.

In addition to quantitative multiple-choice questions (cf. Figure 1), the questionnaire contained open questions to maximize the data (Bowden & Green, 2010) and to capture a diversity of expression describing the phenomenon. The following open questions were asked: 1) Why and how does the competence-based approach and digital badges activate teachers' competence development? 2) What were the best and worst aspects of digital open badge-driven learn-

ing? 3) What else would you like to tell us about your study experiences related to competence-based digital open badges? Large number of participants may be considered high compared to previous phenomenographic studies suggesting that 10 to 15 participants is sufficient for capturing variation (Åkerlind, 2008; Trigwell, 2000). The qualitative open questions provided 52 pages of data.

Constrained Correspondence Analysis

We conducted a statistical multivariate method, constrained correspondence analysis (CCA), also known as canonical correspondence analysis (Oksanen, 2012), in order to analyse the quantitative data. The CCA was computed using R package vegan (Oksanen et al., 2017). Statistical multivariate methods include several options for operating multiple variables (Johnson & Wichern, 2002; Rencer, 2002) as well as summaries of large data sets (Ding, 2006; Oksanen, 2012). In this study, we intentionally reduced the number of variables to reveal the simplified structures of the underlying phenomenon (Hardoon, Szedmak, & Shawe-Taylor, 2004). The CCA was conducted using the nine background variables (sex, age, province, study group, skills set level, occupation, field of education, working experience, teacher qualification) explaining the chosen variables in the competence-based approach (n=15). The results were drawn in a limited 2-dimensional space in correspondence to the given data.

Phenomenographic Analysis

A phenomenographic approach was used to analyse the qualitative data and describe qualitatively varying ways of experiencing the target phenomenon (Marton, 1981). To begin, we familiarised ourselves with the data by reading it repeatedly. The first phase of the analysis focused on identifying participants' ways of experiencing the phenomenon in general terms. Descriptive categories by comparing and contrasting the identified similarities and differences in expressed meanings we developed. In the second phase, logical relationships within and between categories based on consistently occurring themes in order to represent the various ways of experiencing the competence-based approach in digital open badge-driven learning were formed (Åkerlind, 2005). A collective meaning was developed and named through ongoing comparison of descriptive categories (Kettunen, Sampson, & Vuorinen, 2015). We avoided labelling meanings until final hierarchical construction because it could limit further development of categories (Bowden, 2005; Kettunen & Tynjälä, 2017). The final phase of the analysis focused on ensuring that the categories of description met the three quality criteria defined by Marton and Booth (1997): (a) all categories describe clear variations in experiencing the phenomenon; (b) a hierarchical relationship is seen between the different categories in delivery; and (c) a limited number of description categories is presented. The logical relationships represented in the final categorisation reflect collective rather than individual experiences (Kettunen et al., 2015).

Table 2. Share of Inertia

	Inertia	Proportion	Rank
Total	0.0357	1.0000	
Constrained	0.0026	0.0731	8
Unconstrained	0.0331	0.9269	14

Table 3. The Permutation Test for CCA under the Reduced Model

	Df	Chi-square	F	Pr(>F)
Study Group (SG)	5	0.0016	1.2410	0.008
Skills Set Level (SSL)	3	0.0010	1.5208	0.010
Residual	148	0.0331		

Results

The Results of the Constrained Correspondence Analysis

Sherry and Henson (2005) remind us to be mindful of the risk of interpreting insignificant functions. We used permutation tests (Table 3) to ensure the statistical significance of the relationships between variables and demographics. Two of nine explanatory variables were statistically significant (< 5% risk level). We tested the significance using permutation tests (999 permutations): Study Group (SG, 6 levels) and Skills Set Level (SSL, 4 levels). The unconstrained axis shared the major proportion of inertia (Table 2). The eigenvalues of the first (CCA1) and second (CCA2) constrained axis were 8.738e-4 and 5.777e-4. The eigenvalues of the unconstrained axis were 8.613e-3 and 4.825e-3, respectively.

We included fifteen questions based on earlier research into digital open badge-driven learning (Brauer & Siklander, 2017; Brauer, Siklander, & Ruhalahti, 2017) and instructional badging (Ahn et al., 2014; Gamrat et al., 2016; Reid et al., 2015). The coordinate values of the 15 study items for CCA plot (CCA1 and CCA2) were rescaled by multiplying the original coordinate values by 10 in order to make the CCA plot more interpretable. Figure 1 illustrates the relationships between the fifteen study items and the attached gradient vectors of categories SSL and SG as simply as possible to aid interpretation. The Spearman's rank order (correlation matrix of the fifteen study items) also confirmed the distributions of the values of the five-point Likert scale by the groups of the participants.

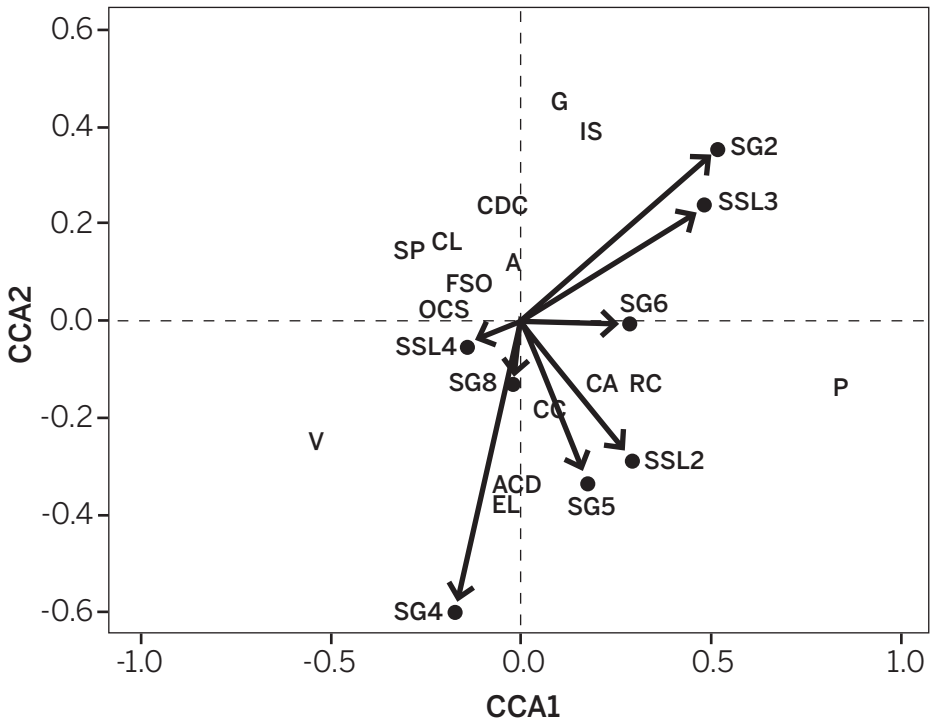

Figure 1. Constrained correspondence plot with reduced dimensionality. Symbols for the categories presenting background variables: SG=Study Group (cf. Table 1) and SSL=Achieved Skills Set Level I-III; and online questionnaire's multiple-choice questions: A=applications in working life, ACD=activate competence development, CA=competence-based approach, CC=competence development within the community, CDC=competence development continuum, CL=competence-based learning, EL=enhanced learning, FSO=flexible study options (time and place), G=the PDP is gamified, IS=independent self-evaluation of existing competencies, OCS=option to customise studies, P=public sharing, RC=recognition of community's competences, SP=option to learn new and up-to-date competences (study progress), V=the variety in extent of required performance

The Results of the Phenomenographic Analysis

Data analysis revealed five distinct categories of description reflecting participants' ways of experiencing the competence-based approach in digital open badge-driven learning (Table 4).

Description of the Categories

In the first category, the competence-based approach in digital open badge-driven learning was experienced as a compulsory performance. Participants here expressed *negative* attitudes towards digital open badge-driven learning. They didn't expect *any added value* in digital open badge-driven learning and considered the model just as another means for testing

and *grading*. Provided learning materials *were not used* and participants expressed that they were *not provided* with scaffolding. Participation was experienced as an obligation, badge applications were "*compulsory*", and participants felt they were being *forced* to use the badges. Their situational motivation was to meet the *mandatory* requirements.

In the second category, participants experienced competence-based approach in digital open badge-driven learning as completing learning assignments. They expressed *concerned* attitudes and felt insecure about providing a demonstration of competence online; further, they felt concerned about sharing their collected badges publicly (which was not required). Participants considered badges to be external *rewards*, and digital badging was a useful tool to *track the progression* of their studies. The option to "test" existing competences in the form of a badge application attempt was highly appreciate like also the possibility to look for learning materials after suggestions for remediation, which created a *forced need* for learning. The scaffold-

Table 4. In-Service and Pre-Service Teachers' Ways of Experiencing the Competence-Based Approach in Digital Open Badge-Driven Learning

	CATEGORIES				
DIMENSIONS OF VARIATION	**Compulsory Performance**	**Completing Learning Assignments**	**Supporting Professional Competence Development**	**Supporting Individual and Customised Learning**	**Building a Learning Community**
Attitude	Negative	Concerned	Neutral	Positive	Enthusiastic
Significance of Digital Badges	No added value	Reward	Encouragement	Achievement	Appreciation
Digital Badging in Practice	Grading	Tracking progression	Development planning	Competition	Shared expertise
Learning Materials	Not used	Forced need	Systematic	Comprehensive	Advanced
Scaffolding	None	Imitative learning	Differentiation	Scaffolding	Peer support and peer scaffolding
Performance	Compulsory	Selective	Progressive	Customised	Applying
Emotions	Forced	Joy	Enthusiasm (badges)	Enthusiasm (team)	Addiction
Situational Motivation	Mandatory	Identification and recognition	Practical	Gaming	Promoting competences

ing provided other than badging was considered *imitation learning* as the teacher showed learners what to do, and the learners "just pushed the buttons". The ability *to select* from a variety of assignments, and learning gave participants *joy*. In general, the *identification and recognition* of competences was found as a motivational process.

They also were eager to learn how they could meet the requirements and were willing to plan accordingly.

The third category describes the competence-based approach in digital open badge-driven learning as supporting professional competence development. In this category, attitudes towards badge-driven learning were *neutral*, and digital badging provided *encouragement*. Participants found the competence-based badge criteria functional for *development planning*, as it allowed them to identify the individual competences needed in working life. Learning materials were utilised *systematically* and learners were motivated to find up-to-date pedagogical models, instructions on technical solutions and practical tips. They also were eager to learn how they could meet the requirements and were willing to plan accordingly. The individual's role became manifest as a professional interested in learning new things and willing to update personal competences. Outside of the OBF, the students were supported by *differentiation*, varying instructional strategies, by conventional means like email. This category revealed a preference for *progressively* deeper and more complex challenges. Here participants expressed sense of *enthusiasm* towards badges even if situational motivation was *practical.*

The fourth category describes the competence-based approach in digital open badge-driven learning as supporting individual and customised learning. Participants expressed *positive* attitudes towards competence-based badge-driven learning. They had great expectations of this "new way of learning" and found significance in visualising the competences achieved. They experienced a strong need for *achievement* and were enthusiastic about the *competition* to collect all the badges and reach the highest level. Participants were *comprehensive* in using learning materials and looked at all available sources, sometimes several times. They considered the option to *customise* studies highly motivational. Here participants were satisfied with the *scaffolding* related to the badge application process and found it inspirational. They felt the provided instructions were accurate. However, they did not reach out for peer advice, even if they were *enthusiastic* about the team spirit and team game. Here participants just enjoyed *gaming*.

In the last category, the competence-based approach in digital open badge-driven learning was experienced as building a learning community. Participants express *enthusiasm* for the badges. These had *appreciation* towards the competences achieved and found it essential to have independent self-evaluation of existing competencies. They also enjoyed choosing the level of competences to share with others. Participants sought to build learning communities and *shared expertise*. They appreciated the learning mate-

rials provided, but searched for *advanced* supplemental information from different sources. Here learners were likely to get inspired by *peer scaffolding and peer support*. The possibility to apply new skills and knowledge in work was expressed crucial. Further, the visualisation of competences were found to be essential on a personal level, supporting *addiction* to competence development instead of gaming while providing an option to *promote competences* to employers.

Relationships between the Categories

In category 1, where digital open badges were experienced as a *compulsory performance*, there was little or no positive potential or impact in competence development. In the second category, badges were considered to be tools and rewards or external mechanical structures, albeit helpful ones. Category 3 a straightforward and practical approach to badge-driven learning was described. Key factors of this approach visualise skills and knowledge in the form of competence-based badge criteria, mastery badge-constellations and meta-badges. This stage is the first to recognize badges' ability to support *professional development*. Participants are able to identify the individual competences needed in working life and to plan accordingly. The following stage (category 4) offers to support *individual and customised* study options, representing the triumph of gamification in *learning*. Gaming and achievements motivate participants towards the highest possible skills achievement. At this level, action is based on a strong goal orientation, experienced as a need to succeed and win with the team. In the most complex category (category 5), digital badging offers to support the competence-based approach ideally suited for success. Here participants express personal responsibility for competence development and seek to *learn and collaborate in a learning community*. They rely on their peers for scaffolding and advice and are the most likely to apply new competences at work. They express enthusiasm for the badges, not for gamification but for competence development. Badges provide them a map for personalised professional development and a vision of new career opportunities.

Discussion

Both used methods highlight the badge learners' experiences and offer to deepen the existing knowledge of digital open badge-driven learning. Quantitative analysis provides a circle of six variables that participants considered essential in the competence-based approach in digital open badge-driven learning: A=applications in working life, CA=competence-based approach, CC=competence development within the community, FSO=flexible study options, OCS=option to customise studies, RC=recognition of community's competences. Like Brauer, Siklander and Ruhalahti (2017), we found that participants experienced the *option to customise studies* and *flexible study options* as important in digital open badge-driven learning. They also found significant the *possibility to apply new competences in working life* in advance (SSL1 and SG1 coordinates situated at the origin). Overall, we are able to conclude that the visual badge-constellation promoted *independent self-evaluation of existing competences* and *identification of individual competences needed in working life*, therefore *enhancing learning and efficient professional development*; however, it was not as efficient as gamification.

The two approaches of the recent study align with earlier research (Brauer, Siklander, & Ruhalahti, 2017; Abramovich et al., 2013; Reid et al. 2015). For example, Brauer et al., 2018 concluded that gamification particularly engages novice and expert level learners. Based on our quantitative findings, *gamification prompts learners* (SG2, SSL3) to continue their studies (Abramovich et al., 2013; Reid et al., 2015) towards the highest possible skills level, especially when they have the option to personalise their study path entirely. This finding is line with Muntean (2011), recognising gamification as a trigger to student progress. Success here seems to relate to the ability to self-evaluate existing competences through the visual constellation of badge criteria (Ahn et al., 2014; Davies et al., 2015; Gamrat et al., 2016; Smith, 2015).

Quantitative findings indicate that professional teachers are more interested in shared expertise and professional development within the working or learning community than becoming involved with the individual competence-based learning and assessment process. Phenomenographic results reveal a way of experiencing digital open badge-driven learning as building a learning community. In general, digital open badge-driven learning seems to enhance professional teachers' perceptions of the competence-based approach in practice. Both approaches indicate that, through public sharing, badges may enhance professional development within working communities; the competence-based approach supports identification and recognition of the different competences achieved (Casilli & Hickey, 2016). In addition, statistics indicate that competence-based digital badges help teachers to plan competence development as a continuum. However, based on the CCA, learners did consider publicizing badges as significant for their professional development.

Limitations and Practical Implications

The study design challenged us in combining two very different methods. The findings of the *phenomenographic analysis provided a wider range of variation in experiences*. The approach allowed us to hear a variety of different, relevant voices, including both negative and enthusiastic tones. To develop a competence-based approach in digital open badge-driven learning, we need to understand both the voice of the few and the voice of the many. In parallel, the methods offer us an enriched view of the different learner profiles experiencing competence-based digital badging, complementing one other by explaining different aspects of the phenomenon. Nonetheless, involving both approaches in the same study challenged us to produce a clearly-structured descriptive and interpretive text.

CCA was originally introduced as a method of plant ecological research (Oksanen et al., 2017). The technique is an extension of correspondence analysis, that allows evaluating different dimensions of the phenomenon. Brauer et al. 2018 applied it for the first time in educational research in 2018. Simultaneously Venuleo, Ciavolino, Vernai, Marinaci and Calogiuri (2018) have applied the method in society and human studies. Already in 1986 Ter Braak explained reciprocal averaging in related canonical correspondence analysis as "a popular ordination technique that extracts continuous axes of variation from species occurrence or abundance da-

ta. Such ordination axes are typically interpreted with the help of external knowledge and data on environmental variables". Multivariate methods are considered mathematically elegant and descriptive; consequently the results may be difficult to interpret (Spicer, 2005). For this reason, the method may not suitable for testing strong hypotheses. In essence, all data were confirmed through researcher triangulation.

Other challenges include the minimisation of the researcher's personal perspective in building reliability in the phenomenographic approach. It should be noted that one of the authors was involved in developing the Learning Online PDP; however, this research does not take a stand on the functionality of the investigated PDP. All themes and categories were probed with the third author, after the first author had analysed them. In addition, logical relationships were not confirmed until categorisation was final (Åkerlind, 2005).

As a practical implication, we suggest that the competence-based approach and digital open badge-driven learning in professional development be applied in ways that ensure customisation and flexibility, which is important to all learners. Assignments should relate to the required evidence for a competence and offer in-service teachers the option to apply the task in their own work; for pre-service students, assignments should provide simulations of challenges in working life. Additional research is needed on designing advanced competence-based digital open badge-driven programs. We also suggest further studies into the negative orientation towards digital open badge-driven learning. Finally, it would be beneficial to further consider the communal aspect of this tool in terms of social and collaborative learning.

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