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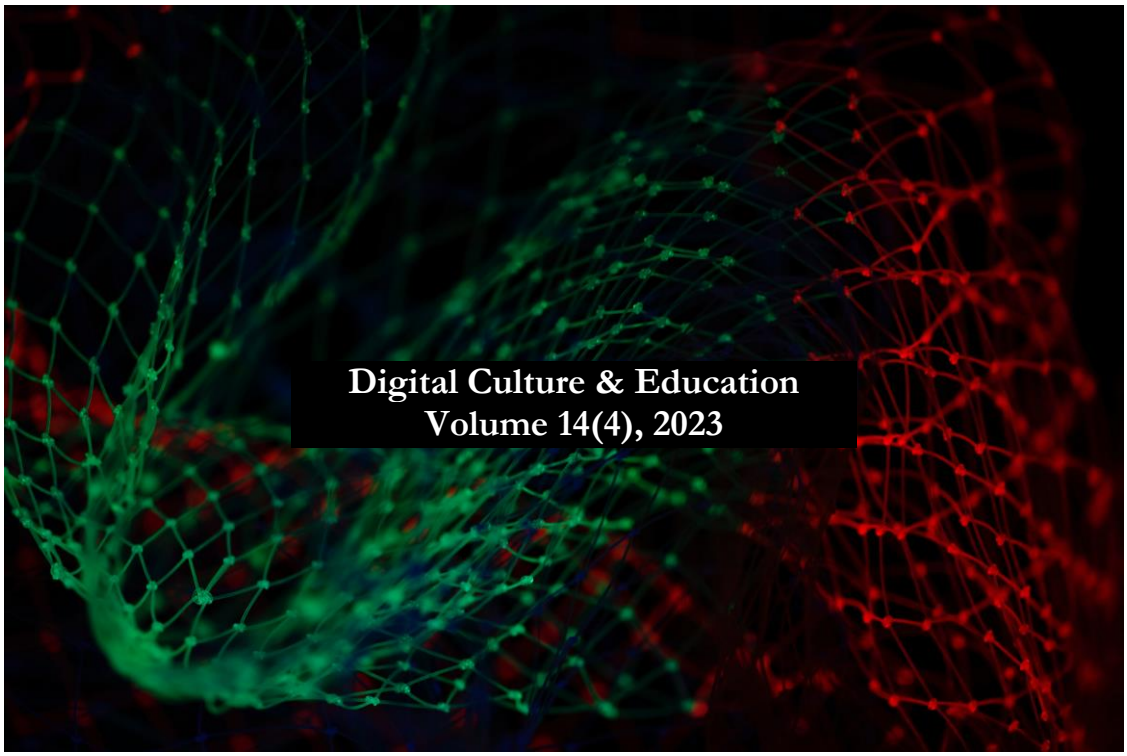

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Professional past, present, and future: Digital platform designs for reflecting on professional competence

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Abstract: *This paper studies how the design of digital platforms can support students' reflection on professional competence. The authors propose a conceptual framework for analyzing properties and functions that are relevant for digital environments for reflecting on professional competences and apply it in a study analyzing a set of existing digital platforms. The results emphasize the importance of multiple temporal vantage points in the design of the digital platforms, namely reflection-before-action (the future), in addition to the more common reflection-in-action (the present) and reflection-on-action (the past), and considers how digital environment design can support reflection from these temporal vantage points. The article offers tools to guide students in their reflection modes.*

Keywords*: reflection; professional competence; digital platforms; design; reflection-before-action*

Introduction

One of the central challenges for students in higher education lies in understanding the practical relevance of their own learning experiences, and how these relate to professional competence (Brauer, 2021). Competence has been characterized as the skills that enable a person to perform tasks in a successful way in the context of work (Le Deist & Winterton, 2005). Competence also includes practical and theoretical knowledge, attitudes, personal, and social skills (Weigel et al., 2007). While education programs and curricula are deliberately designed to allow students to acquire competence, it is not always clear how acquired competences relate to work-life and societal demands. This poses a core challenge for higher education institutions (HEI) (Brauer, 2021). The World Economic Forum outlines the future of working life yearly and highlights the opportunities for people to continuously 'reskill' and 'upskill' (Rubanovich, 2021), in line with the notion of life-long learning (Epstein, 1999). Life-long learning requires that students also reflect on their competence during their education process

In Europe, the concept of competence is institutionalized through the European Qualification Framework (applied in all EU member states), and defined as the ability to apply knowledge and skills independently and autonomously at a certain level (Mulder, 2012). Beyond education and training, the concept of competence also has a core role in corporate strategy development (core competence), human resource management (competence management), and innovation (sectoral competence) (Weigel et al., 2007). Even though competences and competence development are regarded as important and essential, there is very little research on how to support competence self-identification and self-reflection on competence development, especially when taking into consideration current developments in digital technologies that present new opportunities for such personal examination. There are many types of digital tools available to facilitate reflection on learning in the context of higher education, for example, making podcasts (McLoughlin et al., 2006), creating digital movies (Généreux & Thompson, 2008), or using different types of apps (Leinonen, 2016). One approach that has proved especially useful when deliberating on professional competence is the electronic portfolio, or e-portfolio (Rossi et al., 2008, Ebil et al., 2020). An e-portfolio is a digital documentation of a learning path, which has been found to support metacognition among students (e.g., Bokser et al., 2016). However, research on e-portfolios has mainly characterized reflections on competence as retrospective, focusing either on considering previous actions or current actions, and downplaying future-orientated reflection (e.g., Carl and Strydon, 2017, Ebil et al. 2020). In general, the time perspective on reflection is underdeveloped in the context of digital learning platforms. The learner does not necessarily progress according to the curriculum or study plan laid out by the university or educational

program, but rather through the learner's past, present, and future experiences. These temporal vantage points allow for three distinct modes of reflection: reflection of the past, the present, and the future. Competence is not a static state achieved at the point of graduation or employment; rather, competence requires self-reflection (Knapp et al., 2017) and can be understood as a habit that supports life-long learning (Epstein, 1999).

The aim of this paper is to develop a framework for students to reflect on their competence using digital platforms; the framework is then used to examine how digital platforms support reflection on competence development in a higher education context. The following research questions guide this study: (i) what are the prerequisites for enabling different modes of reflection on professional competences in a digital environment, (ii) how are different modes of reflection (past, present, future) enabled in the current digital platforms for reflection on competence, and (iii) based on the findings, what are the implications for the design of these digital platforms? The study is based on conceptual development that draws on illustrative case examples (Siggelkow, 2007). We apply a snapshot perspective (Jensen & Rogers, 2001) on the illustrative cases to depict the current landscape of digital platforms supporting reflection on competence. We aim at developing a framework for classifying and evaluating digital platforms used for reflective purposes in higher education.

This study is structured as follows. First, we examine professional competence and self-reflection, presenting an overview of the core concepts and forming a conceptual framework for assessing digital platforms and how they employ reflection of professional competences. We position our discussion in the context of HEIs and, specifically, digital environments and their interface design. Second, we briefly describe our research method. Third, we present and discuss the illustrative case example and finally, we discuss our findings and present conclusions.

Self-reflection on professional competence

Professional competence is a multi-dimensional construct, understood either as work-related skills on a general, abstract level – for example analyzing and interpreting or organizing and executing (Bartram, 2005) – or as a set of practical and contextual skills required for several profession-specific tasks (Hager, 2017). Le Deist and Winterton (2005) suggest an integrative understanding of competence that combines the abstract and practical perspectives, and which consists of four components:

Cognitive competence, which includes a person's knowledge and their understanding of the underpinning theories and concepts,

functional competence, which includes practical skills and know-how,

social competence, which includes personal attitudes and the capabilities to interact with and understand others, and

meta-competence, which entails 'learning how to learn' (Le Deist & Winterton, 2005, p. 39), and has also been characterized as a person's 'cognitive, critical, and self-reflective capacities' (Bogo et al., 2013, p. 260).

In this view, competence consists of a combination of a person's theoretical, practical, and social skills within a particular professional context, as well as the meta-competence needed to continuously learn and develop.

Thus, the development of professional competence does not only entail practicing skills in action, but also learning from practice through self-reflection (Boud, 1995). It is important to note that self-reflection is not the same as self-assessment, which refers to students evaluating their own work products and processes (Brown & Harris, 2014, Boud 1999). Self-reflection is a broader process, where students try to gain insight into their own skills and knowledge. According to Dewey (1933, p.78), "we do not learn from experience. We learn from reflecting on experience". Reflection is intrinsic to learning (Bolton, 2001) and allows students to process their experience in several ways: their understanding of the experience, why they are partaking in the action and/or experience, as well as the impact it has on themselves and others (Boud, 1999). Subsequently, reflection has been described as arising from a state of perplexity, hesitation, and doubt (Dewey, 1933), discomfort (Brookfield, 1987), disorienting dilemmas (Mezirow, 1990), and questioning, uncertainties, and dissatisfaction (Boud, 1999). Reflective thinking challenges students to critically review their own actions to refine, improve, and/or change. Johnson et al. (2012) argue that self-reflection is best accomplished through interaction with others.

Schön (1983; 1987) characterized two types of reflection, namely: *reflection-in-action* (takes place while the activity is ongoing) and *reflection-about-action* (takes place after an activity is completed). Additional models of reflection have later been put forward by other scholars, such as the reflective cycle by Gibbs (1988), the experiential learning cycle by Kolb (1984), the 5R framework for reflection by Bain et al. (2002), and the model for structured reflection by Johns (2009). We characterize self-reflection on competence as a process of metacognition, where a person does not only know something, but is also aware of the possessed knowledge and its potential for application or its actual use. Mols et al. (2016, p. 2) define everyday reflection as "considering and analyzing past, present and future experiences in order to reassess our thoughts, beliefs, feelings and actions regarding our everyday life." Based on this, we define reflection on professional

competence as the process of *considering and analyzing past, present and future experiences to reassess our thoughts, beliefs, feelings, and actions regarding our professional competence*. Following Schön (1983) and Wilson (2008), we distinguish three separate modes of self-reflection: (i) reflection-on-action, (ii) reflection-in-action, and (iii) reflection-before-action. In the following, we describe these modes of reflection and consider how to interpret them in the context of students' reflections on their own professional competences.

Reflection-on-action

Reflection-on-action can be seen as retrospective contemplation, where a person recalls previous actions in order to evaluate their performance and how to improve it (Cattaneo & Motta, 2020). Moreover, reflection-on-action is a process of linking theoretical knowledge (or simply beliefs) with experiences from practice, to intentionally thinking about how to become a better practitioner (Marcos et al., 2009). Following Le Deist and Winterton's (2005) framework, we suggest that reflection-on-action for professional competence entails critical self-reflection of the acquired cognitive-, functional-, social- and meta-competences relevant for professional work. Applied to higher education, this means reflection on knowledge and skills gained through earlier experiences, which at that point may have been acquired mostly within formal education itself. At its simplest, it means conducting an inventory of perceived skills acquired through education, as well as other relevant experiences.

Reflection-in-action

Reflection-in-action takes place in situations where professional skills and theoretical knowledge are put into action (Fischer and Somerton, 2000), and is generally regarded as an effective way of learning (Coulson & Harvey, 2013). According to Schön (1983) it is difficult to gain insight into our own knowledge without bringing it into action in a practical situation. Thus, our implicit knowledge, skills, and understanding might not become apparent until we act–only then is it possible to perceive and reflect on them (Schön, 1983). Reflection-in-action entails being able to reflect on what happens in a practical situation, and to adjust to continuously incorporating new information and immediate feedback (Mann et al., 2009). For students in higher education, this may entail participating in activities that are relevant for their intended professional work profile, and reflecting on their own skills and knowledge during (or immediately after) the activities.

Reflection-before-action

Whereas discussions on reflection have long been dominated by the concepts of reflection-on-

action and reflection-in-action (e.g., Mann et al., 2009), researchers have more recently suggested that practitioners should also look forward, anticipating which skills, abilities, or traits will be relevant in future situations (e.g., Cowan, 2020). Reflection-before-action has been characterized as imagining future scenarios or possibilities, and then developing strategies for dealing with them (Wilson, 2008). Thus, it includes sensitizing oneself to the possible qualities of future situations and preparing for how to learn from them (Botelho & Bhuyan, 2020). This kind of reflection may be especially suitable for students with little or no practical experience, who may find it hard to reflect on earlier experiences (ibid.). In general, reflection-before-action anticipates future professional work activities and competences in different work situations. As a practical measure, Hager (2017) suggests identifying a set of key occupational tasks and then considering what types of attributes are required to carry out such tasks.

Table 1 summarizes the preceding discussion. The three columns describe the temporal dimensions (or reflection modes), whereas the rows show Le Deist and Winterton's (2005) four dimensions of competence: cognitive, functional, social, and meta-competence. The guiding questions are our own suggestions to exemplify the different modes, based on the preceding discussion. Next, we consider how the design of digital platforms can facilitate different *modes of reflection.*

Dimensions of professional competences	Questions for reflection-on-action	Questions for reflection-in-action	Questions for reflection-before-action
Cognitive competence *Examples: understanding theoretical domains, insights from practice*	What theoretical knowledge have I acquired and how?	In which activities do I currently apply and develop theoretical knowledge? How?	In what future professional activities can I apply my theoretical knowledge? How?
Functional competence *Examples: data collection skills, analysis methods, etc.*	What practical skills have I learnt and how?	In which activities do I currently apply and develop practical skills? How?	In what future professional activities can I apply my practical skills? How?
Social competence *Examples: teamwork experience, collaboration, voluntary work, board membership*	What social skills have I learnt and how?	In which activities do I currently practice and develop social skills? How?	In what future professional activities can I apply my social skills? How?
Meta-competence *Examples: brainstorming, developing new ideas, participation in projects, self-evaluation*	What skills for learning, self-reflection and creative work have I developed and how?	In which activities do I currently practice and develop learning, self-reflection, and creative skills? How?	How can I utilize and further develop learning, self-reflection, and creative skills in future professional activities?

Table 1. Modes of reflection and dimensions of competence

Design for reflection

Self-reflection can be facilitated through digital environments and e-learning platforms (cf. Piersig et al., 2017; Zheng et al., 2018). This requires the digital environments to be well designed and rooted in an understanding of the end-user's needs, abilities, and constraints (Hassenzahl, 2010). Good design implies sufficient usability and positive user experiences, which are important factors in any digital environment, especially in educational digital environments (Unal & Unal, 2014). Not meeting the requirements may result in users' failure to accomplish tasks or learn, failure to interact with content, low adoption of the environment, or even drop-outs (Hassenzahl, 2010).

To effectively support reflection on competence, the design of the user interface must support the reflection process. Researchers have approached the interface design for reflection in many ways. On a general level Baumer et al., (2014, p. 97) characterize it as introducing "interventions designed to support reflection". This can include fostering pauses, detachment or serendipity (Bagnara & Pozzi 2012), or situations that are unfamiliar, uncertain, or puzzling (Baumer, 2015). According to

Bagnara and Pozzi (2012, p. 1111) such designs should enable the user to depart from "the flow of activity to reach a space for reflection", thus characterizing reflection as something that requires the user to move outside everyday experience.

Fleck (2012) suggests a set of practical approaches to fostering reflection on a series of deepening levels, ranging from level R0 (shallow) to level R4 (deep). The activities involved in supporting the different levels can be summarized as follows:

R0 Recording knowledge and experience for later revisiting

R1 Posing questions to make a person reflect

R2 Enabling a person to see events and information in new ways and question it

R3 & R4 Enabling a person to question their assumptions and knowledge deeply

According to Fleck (2012), levels R3 and R4 are difficult to achieve using only technology. However, technology can support the achieving of levels R0-R2, which, in turn, facilitates reaching deeper reflection and levels R3-R4.

Within the context of digital platforms, reflection has been approached using the concept of *personal informatics systems* (Epstein et al., 2020). Li et al. (2010, p. 168) define personal informatics as systems that "help people collect personally relevant information for the purpose of self-reflection and gaining self-knowledge". Li et al. (2011) outline themes that guide people in using their own personal information for reflection. These include the user's understanding of their *current status*, their *history* leading up to the current situation, and their *goals* for the future. Informatics systems can thus help the users find discrepancies between their current status and future goals and identify factors that help explain their status. This can be used to guide the design process by ensuring that the system is able to capture and process information in a way that supports reflection.

Digitally supported reflection on competences

Based on Schön (1983) and Wilson (2008), we identified three modes of reflection, namely reflection-on-action, reflection-in-action, and reflection-before-action. Furthermore, professional competences have been categorized into cognitive, functional, social, and meta-competences (Le Deist & Winterton, 2005). The temporal dimensions of reflection thus prompt the user to reflect on past, present, and future experiences and contribute to cognitive, functional, social and/or meta competences, including what (s)he has learned/will learn and what skills (s)he has acquired/will acquire. The goal of the user interface is to guide the user smoothly and seamlessly through the reflection process, arriving at insights, statements, descriptions, states, or identification of skills that eventually constitute competences. Literature on design for reflection suggests that a system

that fosters reflection involves recording information and experience for later reflection, and then introducing different types of interventions that allows the user to reflect in the form or questions or pauses, or in presenting information in a surprising way. We summarize these ideas in terms of a conceptual framework (Figure 1). The framework can be used as a guide for evaluating digital platforms and provides information for both our data collection and analysis. Its novelty lies in identifying vantage points (the past, the present, the future) as elements that support reflection.

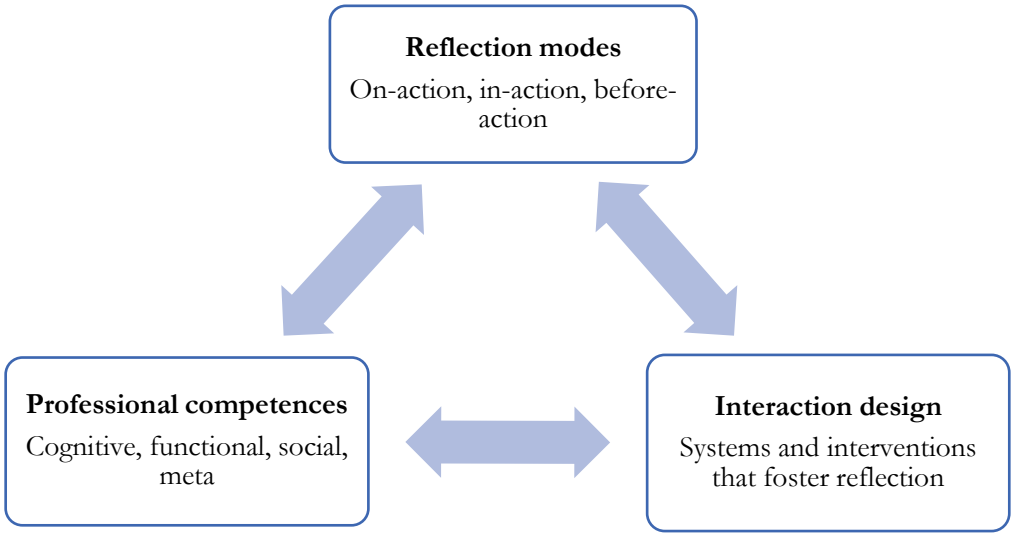

Figure 1. Elements supporting reflection on professional competencies in digital environments

Method and illustrative case examples

We compiled a list of digital platforms identified during several rounds of online search and chose to focus solely on digital platforms that enable the user to practice reflection through writing or with the help of audiovisual elements. Picture-based platforms (e.g., Pinterest) were thus excluded from the study. We initially identified 34 digital environments and/or platforms that we subsequently narrowed down to eleven by limiting the empirical study to platforms that included a test or demo versions and provided a sufficient description of their functions (see Table 2). In addition, the selected case examples represent leading solutions available for HEIs, with a variety of factors being examined. The chosen digital platforms included both global as well as regionally produced solutions. Four of the eleven platforms have been locally designed in the Nordic countries. However, all platforms have English versions available, and thus the descriptions of the

illustrative case examples could be collected in English.

Illustrative case	Description	Web link
Case 1: Yoop.fi	Self-assessment tool for entrepreneurship competences	https://yoop.fi/en/self-assesment/
Case 2: Desire2Learn	E-learning platform designed for online courses	https://www.d2l.com/en-eu/higher-education/
Case 3: JYU e-portfolio	E-portfolio for tracking and making visible competences	https://www.jyu.fi/studentlife/studentlife/en/eportfolio
Case 4: Bulb	Digital portfolio to collect, share and showcase work	https://my.bulbapp.com/higher-education/
Case 5: Kudin	Self-assessment tool for career planning	https://kudin.fi/en
Case 6. Pebblepad	E-learning platform designed for online courses, including online portfolio	https://www.pebblepad.co.uk/
Case 7: PortfolioGen	Online portfolio for showcasing skills and experience	https://www.portfoliogen.com/
Case 8: RCampus	Online portfolio for showcasing skills and experience	https://www.rcampus.com/index.cfm
Case 9: Mahara	E-learning platform including online portfolio for showcasing skills and experience	https://mahara.org/
Case 10: Foliotek	Electronic business card, display of certified badges	https://www.foliotek.com/professional-portfolio
Case 11: Myefolio	E-portfolio for demonstrating skills	https://myefolio.com/highered

Table 2. Overview of illustrative cases

The case data were drawn from publicly available sources, as indicated in Table 2. For each illustrative case, we collected product descriptions, manuals, and testimonials (written and audiovisual) for further analysis. We also made notes on language versions, demo versions, audiovisual content, the availability of a mobile version, and other material (articles written by third parties etc.). In the first round of content coding, two researchers were responsible for independently coding the data and demo versions of each illustrative case according to the elements of the conceptual framework (Figure 1). Descriptions that fit with reflection modes and competences were coded under each concept and sub-concept, while the interaction design was analyzed according to whether the digital platform's design supported reflection; this was followed by a short explanation or motivation for the outcome of the analysis. After the initial coding, all authors discussed the cases comprehensively. In the second coding round, all authors independently coded the illustrative case examples to verify the interpretations, and to further complement coding from the first round.

Results

We found both similarities and dissimilarities in how the illustrative case examples were presented. Some were described clearly as e-portfolios or digital portfolios, while some comprise solutions, such as online or e-learning platforms. Regardless of the preferred description by the developer, all illustrative case examples included a digital platform for students to document and showcase learning, experiences, and competences. Next, we elaborate on the user interface design principles, professional competences, and reflection modes separately.

Interaction design

Three cases (1, 5 and 10) included a guide or instructions for how to reflect and how to document reflections in the digital platform. For instance, Case 1 instructed the user on how to go about converting knowledge and skills into ECTS[1] credits and offered a self-assessment tool with guiding questions. Case 5 included a similar self-assessment tool with guiding questions. The most striking finding was that most of the illustrative case examples did not provide guidelines or instructions for how to reflect – not regarding professional competences nor any other specific theme. The user interfaces do not trigger reflection by prompting the user to reflect; from an interaction design point of view, this activity becomes the responsibility of the user and is assumed to be instigated by the user alone. This requires the user to be self-organized and goal-oriented, as documenting skills and competences would need to occur on the initiative of the user, without guidelines and other support integrated into the user interface. In fact, most of the illustrative case examples remain on level R0 of Fleck's (2012) framework, only assisting the user in recording knowledge experience for later reconsideration. This may subsequently have a negative effect on the ability of the user to reflect on professional competences.

Professional competences

Next, we analyzed the cases to evaluate to what degree they enabled reflection on the four competence types of Le Deist and Winterton (2005). Guidance for documenting cognitive competences, i.e., students' ability to understand theoretical domains and to draw on insights from practice in relation to those domains, is indicated by only a few illustrative case examples (3, 6 and 11).

> "What do I know? How do I talk about it? How do I show it? The opportunity to link together know-how and proof of it = show & tell." (Case 3)

[1] European Credit Transfer and Accumulation System

> "Engaging students by prompting them to prepare, question & challenge the content they are learning." (Case 6)

Functional competences refer to possessing skills suitable for, for instance, data collection and data analysis. Most of the case examples support and guide the documenting of functional competences (cases 1-3, 5-9), but describe these in rather vague and general words, using 'skills', 'experiences', and 'work' as the main concepts. There is thus room for interpretation by the user regarding what functional skills are.

> "The matrix helps you to track, review and describe your professional skills and competences. See how your previous experiences have contributed to their development, identify gaps in relation to your future career goals and use the matrix when planning your study path. Describe the competence you have in the matrix and add custom skills when needed." (Case 3)

Social competences include collaboration skills, team working skills, and engagement in different settings, such as board work and volunteer work. In cases 1 and 5 especially, both of which include a self-assessment tool, the user is guided towards reflection through questions such as 'I am confident talking to people I don't know' and 'I have developed contacts with employers'. Case 6, 10, and 11 also indicate support for reflecting on social competences but articulate and frame their guidance differently.

> "Showcase authentic work. Demonstrate your soft skills and mindset." (Case 10)
> "Stand out from the crowd by using your myeFolio content to document your "soft skills" to employers – problem solving, teamwork and collaboration, communication and conflict resolution." (Case 11)

Meta-competences encompass the ability to create, innovate, and participate in related processes. Case 1, 3, and 5 direct the user towards reflection on meta-competences.

> "ePortfolio is not only a tool where you gather your skills and demonstrate your previous experience, but you will also be able to plan and design your studies in a way which are meaningful for your future. You are given the opportunity to think of your professional aims and goals which you are trying to achieve." (Case 3)
> "I have distinctive achievements and interests which make me stand out from others. I can assess what kind of organizations would suit me. I can identify what motivates me. I can list my strengths. I'm not familiar enough with my strengths and limitations to plan my future." (Case 5)

Reflection modes

We analyzed our material to identify an underlying temporal direction or vantage point. For instance, the previous citations used words such as 'describe', 'discover', 'showcase', 'represent', and so forth. These indicate a state, in which the student is reviewing knowledge and skills based on past experiences and learning outcomes. In many cases, reflection-in-action was referred to as documenting work practice or internships to receive feedback from an instructor or teacher. We also noted that there were less words and descriptions conveying a future vantage point, even though this perspective exists. In these cases, the guidance is often linked to goals ('planning', 'setting', 'linking'). In fact, only three cases (3, 5, 11) encompass all vantage points.

Concerning reflection-on-action, the illustrative case examples were mainly designed to record and display earlier learning, 'what you have learnt'. Hence, reflection-on-action mostly meant reviewing past experiences up until the moment of accessing the digital platform. In addition, the instructions often focused on producing content for informing third parties, such as potential employers or evaluators (teachers, course instructors). However, the demo versions and descriptions showed little or no guidance regarding reflection-on-action; the user was required to recall experiences and learning outcomes, acquired know-how and subsequent skills, rather than to recognize skills, and then elaborate and reflect on them.

> "MyeFolio empowers [students] to create a personalized collection of learning outcomes, reflections, discoveries, activities, and qualifications - in essence, a living showcase of their education, work and achievements. [Students can] reflect on what they have learned throughout an individual unit or an entire year." (Case 11)
> "Bulb tracks all of your work in the cloud so you can refer back to what you learned in college throughout life" (Case 4)

Reflection-in-action refers to contemplating current and on-going experiences, activities, and learning. In most of the illustrative case examples, the reflection-in-action was directed towards elaborating on trainee periods and learning periods. Hence, reflection-in-action implies practical learning, or learning in practice.

> "[...] direct reflection of specific tasks/assignments when they are being completed." (Case 2)
> "[Customer testimonial, McMaster University] being able to view progress in real-time ensures students receive the support and guidance they need, exactly when they need it. [...] PebblePad helps our students reflect on what they are learning by

> documenting curricular, co-curricular and community learning and the relationship between." (Case 6)

Reflection-before-action, or reflection on the future, were scarce in the illustrative case examples. While there were guiding questions that led the learner towards future-focused reasoning and thinking, these were generally phrased in terms of 'setting goals' and indicated some vague point in the future. It is unclear if this helps the user envision a future that is linked to previous and current learning. Which learning experience should the user acquire to achieve future goals? Even though the descriptions can be interpreted as reflection-before-action, there is a gap between the guiding questions and the desired action by the user, i.e., the integration of learning and experiences in the digital environment.

> "ePortfolio helps you to craft your own path. Where do you head for next year? Where do you see yourself in five years or do you even have an ultimate goal? Whatever your objective might be–or might not be, ePortfolio helps you to set your goals." (Case 3)
>
> "[Students can] learn how individual projects and activities connect towards bigger goals and achievements" (Case 11)

Summary of illustrative case examples

Some of the illustrative case examples have clearly been designed to support reflection during the learning process and help learners to showcase their reflection to different external stakeholders, such as teachers or potential employers. In a sense, the digital environment or tool becomes the medium, through which the student can display his or her ability to reflect on experiences as well as to communicate to others the meaning of those experiences.

While exploring how digital environments support the reflection processes of professional competences, we also noted the value they create. In addition to facilitating the student in identifying competences and reflecting on past, present, and future experiences, they enable a link between external stakeholders and the user, providing a common language and aligning interests (assessments of knowledge, suitability and/or conformity to objectives). The digital platform partially or fully replaces social interaction as a means of setting up reflective practices and processes; the interaction occurs within the digital environment between the user and different elements that are purposefully designed to ascertain, enable, and further support reflection. All of the illustrative case examples allowed for feedback, instructions, and guidance or comments by other individuals, such as teachers, colleagues, employers, team members, etc. As reflection on

professional competences becomes digitized, so do the social interactions that are part of the reflective processes. This is contrary to, for instance, Johnson et al. (2012), who strongly argue that self-reflection is best accomplished through real-life interaction with other human beings. This leads us to note that research on reflection should, to a wider extent, take technology into consideration, for instance, by treating digital environments as a context of and for reflection.

Table 4 summarizes the illustrative case examples, offering an overview of the identified elements of each illustrative case example. Currently, contemporary digital platforms tend to a lack future-orientation that would support reflection-before-action. Moreover, many lack any guidance for identifying different competences; in particular, reflection of cognitive competences and meta-competences are insufficiently supported in contrast to functional and social competences which are supported in most of the illustrative case examples. This raises the question whether the developers and providers understand the pedagogical perspective well enough to meet the needs of the HEIs.

Illustrative case	**Reflection modes**	**Competence dimensions**
Case 1: Yoop.fi	On-action, In-action	Functional, Social, Meta
Case 2: Desire2Learn	On-action, In-action	Functional
Case 3: JYU e-portfolio	On-action, In-action, Before-action	Cognitive, Functional, Social, Meta
Case 4: Bulb	On-action, In-action	-
Case 5: Kudin	On-action, In-action, Before-action	Cognitive, Functional, Social, Meta
Case 6. Pebblepad	On-action, In-action	Cognitive, Functional, Social
Case 7: PortfolioGen	On-action, In-action	Functional
Case 8: RCampus	On-action, In-action	Functional
Case 9: Mahara	On-action, In-action	Functional, Social
Case 10: Foliotek	On-action	Social
Case 11: Myefolio	On-action, Before-action	Functional, Social, Meta

Table 4. Summary of illustrative case examples based on the conceptual framework

Discussion and conclusions

The objective of this article was to study digital platforms and how they support reflection on professional competences among students of higher education. An integrative understanding and

categorization of competences (Le Deist & Winterton, 2005) allowed us to analyze digital platforms in detail as to how well they support the students' reflective practices. By distinguishing between different dimensions of competences conjointly with reflection modes and interaction design, we further the knowledge of digitally enhancing reflection processes. Our results provide insight not only for the developers of the digital platforms, but also educational developers in terms of how they may support students in verbalizing, visualizing, recalling, and reacting to experiences that eventually form their professional identities and competences. Such support also facilitates and empowers students, later in their working life, to 'reskill' and 'upskill' (Rubanovich, 2021). We thus highlight the need to focus on elements that support reflection on professional competences in the digital environment in order to facilitate and direct reflection practices and processes among higher education students. As noted by Moon (2004), it is possible to learn to reflect, but previous research has focused largely on the roles of teachers and learners in such processes. This excludes the digital environment, which is where reflection practices and processes increasingly take place, and where documentation of reflection occurs. Our main contribution is thus an empirically validated conceptual framework that builds on the link between the digital environment, specific vantage points for reflection, and categorized professional competences. We were able to show, through eleven illustrative cases, that current digital platforms leave much to be desired with regard to supporting reflection on professional competences.

Thus, we argue that it is important to incorporate practices enabling reflection from different vantage points into digital tools. Relevant questions would be to consider how students relate to the dimension of time, how well they can reflect (create meaning and make sense) on activities and experiences here and now, and whether they need further reflection once they have moved on and these focal experiences become a part of their past. However, we noted that a future-orientation is absent in the majority of our illustrative case examples. This is concerning, as it may hinder students from directing their learning and making adequate and informed decisions on which competences to acquire. Once they can identify existing and lacking skill sets and competences that may be required in their intended work areas, students are better equipped to design their own learning paths.

Our findings also indicate that the reflection process of higher education students may not be as contingent on social interaction as previously suggested (e.g., Johnson et al., 2012). We argue that the digital environment may compensate for social interaction in cases where it is carefully designed to provoke thoughts and lead the user forward in his/her self-reflection (cf. Bagnara & Pozzi 2012). The digital environment can serve as a tool to foster epiphanies, provoke ideas, or prolong a reflection process. Thus, the interaction design is of importance, as the user must be

comfortable in the digital environment; the digital platform can guide its user towards reflection through recording information, and can prompt the user to update this information. However, for effective reflection, the platform should include designed interventions that foster reflection, such as posing questions about the recorded information, or presenting it in new or surprising ways (Fleck, 2012). Due to the increasing role of software and systems in the HEI context, it is important that students can navigate through such platforms and find them sufficiently valuable to use on a regular basis. Systems can be designed to communicate their value in terms of achieving an aim, such as more knowledge about oneself, or insight into the professional competencies one has or should acquire.

To convert our contributions into practical implications, we propose that educators increasingly include temporal vantage points, i.e., reflection modes, in the context of identifying professional competences. While our empirical study shows that not all digital environments are optimal for supporting reflection on professional competences, they still aid the student and create value in terms of initiating and facilitating reflection processes, especially towards social and functional competences. To guide the students, simple but thought-provoking questions are pivotal, and can be categorized according to their intended outcome. We suggest a categorization of i) descriptive, ii) comparative, and iii) critical questions in combination with the reflection modes that eventually guide students in both digital environments and in human interaction situations (Table 5).

Guiding questions	**Reflection-on-action**	**Reflection-in-action**	**Reflection-before-action**
Descriptive	What has the student done in the past?	What has the student recently done? What is the student currently doing?	What can the student do?
Comparative	What could the student have done differently?	What are the students' alternatives? What was others' feedback?	What are the student's alternative approaches for doing this?
Critical	What has the student learned?	What are the student's current insights from doing this activity?	What can the student still learn more about?

Table 5. Guiding questions for reflection modes

These simplified questions follow our conceptual framework (Figure 1). Descriptive questions aim at detailing experiences, comparative questions aim at identifying alternative scenarios and solutions, while critical questions aim at identifying the next steps and missing components. In combination, the questions can aid the student in identifying past, current, and future professional competences. After drawing on the guiding questions for reflection modes (Table 5), the teacher

may further guide students towards deeper reflection on competence development utilizing the questions in Table 1, which outline competences in detail. The guiding questions allow the teacher to be aware of the aim of the questions and that their outcome relates to different levels and categorizations of reflection.

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