Potentials and Limitations of MOOCs in Vocational Teacher Education

Postgraduate Vocational Students' Perspectives

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Abstract

The aim of this study is to explore vocational education student teachers' (VTE students) experiences with massive open online courses (MOOCs) as digital learning resources in vocational teacher education. The study explores two research questions: 1) *What potentials and limitations in MOOCs do VTE students perceive as a learning resource in vocational education and training (VET) and vocational teacher education (VTE)?* 2) *Through the lens of the Digital Competence Framework for Educators (DigCompEdu), how can MOOCs enhance VTE students' specific digital competences?*

The data material comprises assignments and reflection notes written by 100 VTE students in an add-on model of vocational teacher education after engaging with MOOCs. The data was analysed according to the steps in reflexive thematic analysis.

The findings were sorted into three overarching themes: potentials, limitations and frame factors. Potentials described by VTE students include flexibility, variety, activity, differentiated instruction, shareability and actuality, while limitations stated were related to interactions, relationship building, practical skills, tacit knowledge, *Bildung* and catchability. Frame factors, such as students' and teachers' preconditions and economic resources, were perceived as both potentials and limitations.

Key words: massive open online course (MOOC), vocational teacher education (VTE), vocational education teacher students (VTE students), vocational education and training (VET), digital competency, DigCompEdu

The findings illustrate that, as digital learning resources in VTE, MOOCs have many potentials, but also several limitations. Vocational teachers must be cognisant of when, where and for what purpose(s) MOOCs are beneficial learning resources. MOOCs cannot replace a physical presence in VTE or in VET but can be a valuable complement. To facilitate the development of students' digital skills, VTE students must develop and strengthen their own professional digital competence. Despite criticisms that the European DigCompEdu framework does not accommodate the unique characteristics of vocational subjects, this study shows that DigCompEdu encompasses a wide range and captures many central aspects of the multifaceted digital competence that vocational education teachers need in order to educate future skilled workers for a diverse workforce.

Introduction

The aim of this study is to explore vocational education teacher students' (VTE students) experiences with massive open online courses (MOOCs) as digital learning resources in vocational teacher education (VTE). MOOCs include open digital learning resources that allow students to implement ready-to-use course packages in their teaching, and can include both subject-related material and teaching methods. As digital learning resources, they offer several opportunities for VTE students (Murphy et al., 2013; Tømte, 2019), and simultaneously contribute to innovative learning and the development of a diverse range of teacher education programmes (Tømte et al., 2020). National studies show that little priority has been given to the development of teacher students' professional digital competence (Hjukse et al., 2020; Tømte et al., 2013), that digital competence is only included in the course descriptions to a small extent, and that digitalisation efforts are weakly anchored in the educational institutions' management (Tømte et al., 2013). Among VTE students, there is a notable scarcity of research of information and communication technology (ICT) training (Cattaneo et al., 2022, Lahn & Berntzen, 2023; Lyckander, 2023; Røkenes & Krumsvik, 2014). This particularly concerns ICT training in relation to the use of MOOCs (Paton et al., 2018; Ramlo et al., 2022).

The candidate surveys conducted at NTNU between 2017 and 2021 consistently show that VTE students report a growing need for further training in the use of digital tools. Analysis of how well their study programme prepares them in areas such as oral presentations, written communication and digital tool proficiency reveals that the latter is consistently identified as the weakest area across all cohorts (NTNU, 2019, 2022). Similarly, group interviews with school principals reveal that vocational teachers also exhibit a deficiency in digital skills. When discussing the type of competence development necessary for vocational teachers to remain current and provide effective instruction, principals highlight the importance of both analytical abilities and digital skills for these educators (Aspøy et al., 2017).

To facilitate the development of VET students' digital skills, VET teachers must develop and strengthen their own professional digital competence. In 2017, based on an initial literature review and the synthesis of existing models of developing digital competence among educators, the European Commission's Joint Research Centre introduced a theoretical framework termed the Digital Competence Framework for Educators (DigCompEdu). This framework is an attempt to create a universal set of digital skills among teachers relating to the use of software and

hardware, regardless of educational level, subject matter or geographical location (Redecker, 2017).

European Framework for the Digital Competence of Educators (DigCompEdu)

DigCompEdu provides a description of 22 educator-specific competences organised as three main categories: Educators' professional competences; Educators' pedagogical competences; and Learners' competences. These three are further divided into six elementary areas: 1) Professional engagement; 2) Digital resources; 3) Teaching and learning; 4) Assessment; 5) Empowering learners; and 6) Facilitating learners' digital competence (Redecker, 2017). Each area features distinct indicators that relate to activities in learning and teaching, educators' personal development, and the broader contexts occurring at the interplay between the development of the information society and pedagogy (Tomczyk & Fedeli, 2021). However, the core of the framework is defined by areas 2-5. Together, these areas explain the digital competence that educators need in order to foster efficient, inclusive and innovative teaching and learning strategies. Moreover, this pedagogical core of the framework is complemented by areas 1 and 6. Area 1 is directed at the broader professional environment, while area 6 details the specific pedagogical competences required to facilitate students' digital competence (Redecker, 2017). What is particularly important is that the framework is not focused on technical skills. Instead, DigCompEdu aims to determine how digital technologies can be used to improve and innovate in education and training (Walter & Pyżalski, 2022). An overview of the DigCompEdu is presented in Figure 1.
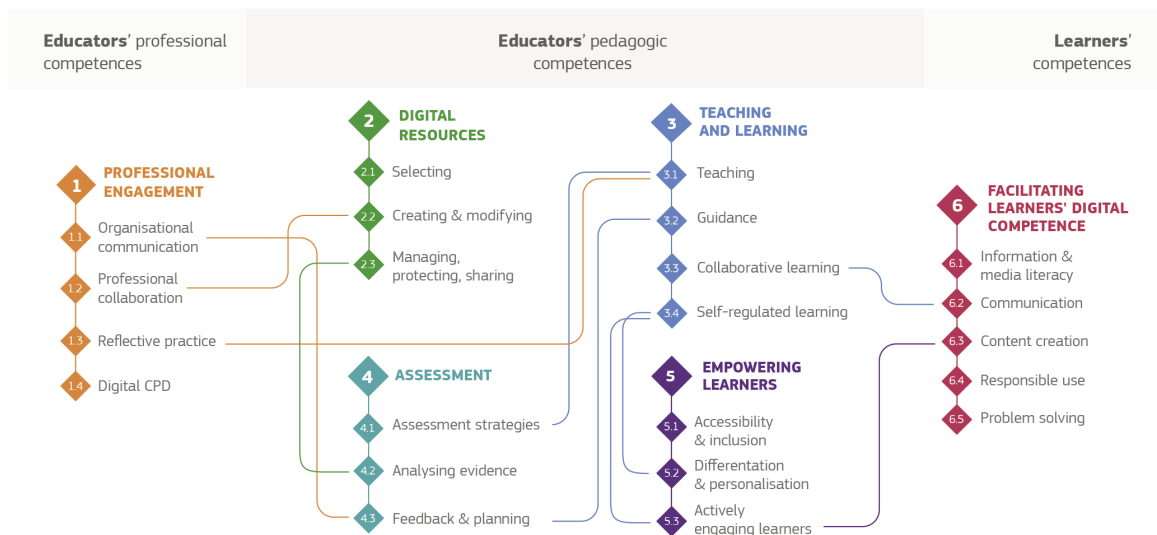
Figure 1. The three main competence categories and six areas of the DigCompEdu framework © (Redecker, 2017, p. 8)

The Framework also introduces a progression model that is designed to assist educators in evaluating and enhancing their digital competencies (Figure 2). It presents a six-stage

developmental pathway for an educator's digital competence, providing a roadmap for identifying and implementing the necessary steps to improve their current level of competence. Initially, at the Newcomer (A1) and Explorer (A2) stages, educators absorb new knowledge and develop basic digital practices. They are aware of the potential of, and interested in exploring, digital technologies for enhancing pedagogical and professional practices. Progressing to the Integrator (B1) and Expert (B2) stages, the educators experiment with digital technologies in a variety of contexts and use them creatively. They apply and refine their digital practices with a more structured approach. At the apex – the Leader (C1) and Pioneer (C2) stages – educators rely on a broad repertoire of digital strategies, and they know which will be the most appropriate to choose for any given situation. They continuously reflect on their practices, keep themselves updated on new developments and ideas, disseminate their insights, critique existing practice and develop new practices (Redecker, 2017, pp. 29–30).
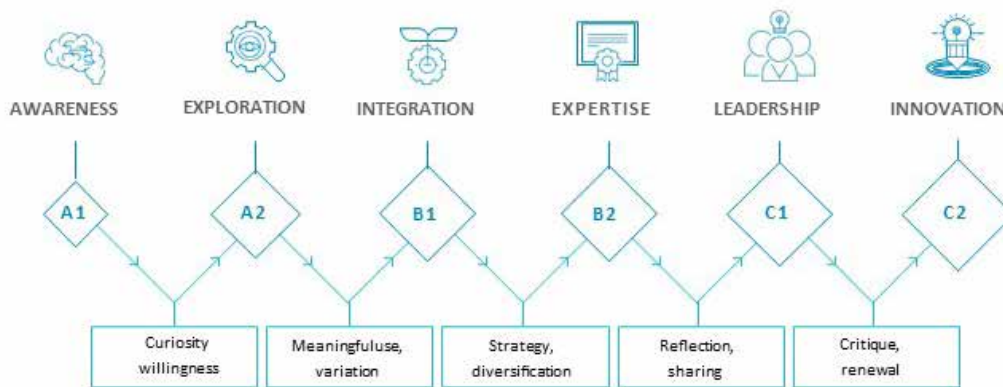
Figure 2. DigCompEdu progression model © (Redecker, 2017, p. 29)

The DigCompEdu framework has been criticised for not being sufficiently context-sensitive for the multiple learning venues and partners in VET (Kämäräinen et al., 2019). Although some have suggested the need to create a conceptual model of VET teachers' professional digital development (Lahn & Berntzen, 2023), others have tested a DigCompEdu measurement tool while integrating VET-specific items in order to better grasp the unique characteristics of VET (Cattaneo et al., 2020).

MOOCs as learning resources

The term *MOOC* is described by Kelentrić et al. (2017) as an open digital learning resource. MOOCs are digital online courses that are characterised by being offered via the internet to many people, or having the potential to reach many (massive). These courses are often free and openly accessible, and are characterised by their flexibility (Haber, 2014). For example, videos can easily be converted into a flipped learning environment (Talbert, 2017). Research on MOOCs points to both strengths and weaknesses. The most significant factors appear to be the visibility and publicity of knowledge, the accreditation of courses, opportunities for flexible and autonomous learning, and notably the improvement of assessment practices in MOOCs (Fernandez-Ferrer,

2019). The capacity for self-regulated learning is a key factor for MOOC students because learning in MOOCs requires significant effort from the learner (Alonso-Mencia et al., 2020). According to Perez-Alvarez and colleagues (2018), MOOC students face greater challenges in achieving their learning goals than other students, precisely because of a lack of self-regulation skills.

Another identified weakness of MOOCs concerns the lack of relatedness, with regard to both teachers and fellow students. MOOC design seems to inadequately meet the MOOC participants' sense of relatedness (Lan & Hew, 2020). The absence of face-to-face interaction and support from teachers and fellow students has been a major problem with MOOCs (Bralic & Divjak, 2018).

By studying participants in 44 MOOCs, Evans et al. (2016) found consistent patterns in how student characteristics were associated with engagement, persistence and completion. The lack of prerequisite skills when working with MOOCs has important implications for students' learning, engagement and drop-out.

MOOCs as learning resources in VTE and VET

A study from a Finnish university found that MOOCs provide both a suitable method for updating knowledge and an easy way to participate in continuing vocational training. Working students considered MOOCs as a good way to learn new skills in their chosen field, and the major motivation for participating in them was a desire to gain the knowledge and skills that they needed in their job (Drake & Rajaorko, 2018). VET has an educational focus that is designed to deliver industry knowledge and practical skills in order to perform a specific job role (Paton et al., 2018). According to VTE students, MOOCs have potential as a learning resource, both for learning ICT and for the vocational subjects. Technology and digital tools can serve as learning resources and as an *extra teacher*, but as a digital learning resource, MOOCs cannot replace the VET teacher (Ramlo et al., 2022).

Building stronger structures that promote deeper levels of engagement and knowledge retention in MOOCs is of significant interest to teachers in VET. Feelings of isolation can be reduced if consideration is given to the design of the social interaction tools being utilised. Participation patterns, course flexibility and the accommodation of time differences are also strong contributors to how the learner engages with the course materials (Paton et al., 2018).

In this study, we will explore VTE students' experiences with MOOCs as a learning resource in VTE and VET, and further use the *DigCompEdu* framework to discuss the findings. Two research questions are explored: 1) *What potentials and limitations do VTE students perceive in MOOCs as a learning resource in VET and VTE?* 2) *Through the lens of DigCompEdu, how can MOOCs enhance VTE students' specific digital competences?*

Methods

We will now introduce this study's participants, describe the data material developed through the project, outline the data analysis process, and address some ethical considerations.

Participants

The participants are VTE students in an add-on model of VTE, with courses in pedagogy and vocational didactics in a two-year part-time postgraduate programme. The programme builds

on student teachers' vocational or professional qualifications and work experience. A total of 100 VTE students were divided into three classes, with 36 attending the first year and 64 attending the second year (Table 1).

Table 1. Overview of the participants, assignments and data material

	Year, Semester	**Time**	**Assignment, part a**	**Assignment, part b**	**Data material**
Class 1 (n=36)	First year, second semester	Spring 2020	Create teaching based on the content and methods introduced in the MOOCs, including reflection based on their own learning process. (a-1)	Reflect upon potentials and limitations with MOOCs. (b)	Reflection notes
Class 2 (n=30)	Second year, second semester	Spring 2020	Reflect upon how technological and digital tools can contribute to differentiated instructions and student-active teaching. (a-2)		Reflection notes
Class 3 (n=34)	Second year, first semester	Autumn 2021	Create a digital story. Participate in World Café where they discussed how technological and digital tools can contribute to differentiated instructions and student-active teaching. (a-3)		Reflection notes

About half of the VTE students who participated in this study were from health care professions, predominantly nursing. The remaining were enrolled in a variety of technological vocational programmes, including restaurant and food processing, nature management, and service and transport. The average age was around 35, and about half of the VTE students were in a teaching position alongside their studies.

Data material

The data material is generated from a development project in which MOOCs were used as learning resources for VTE students. The MOOCs were developed through two ERASMUS+ financed projects: Online Platform in Vocational Education and Training (OPVET) and Digital Internationalization in Vocational Education (DIVE). These projects were designed to strengthen VTE students' digital, intercultural and language competences (Utvær et al., 2022). For a closer look at the material developed by the projects, see the projects' websites (DIVE & OPVET, 2023).

In the spring of 2020, 36 first-year and 30 second-year VTE students (class 1 and 2 respectively) were given the task of immersing themselves in a self-selected topic within the framework of three MOOCs that had been developed as part of the OPVET project. The topics they could choose from were: Copyright and General Data Protection Regulation, Blog and Interactive whiteboard. In the autumn of 2021, 34 second-year VTE students (class 3) were given the task of immersing themselves in a self-selected topic within one of three MOOCs that had been developed through the DIVE project. The themes were closely linked to interdisciplinary topics in the Norwegian core curriculum Knowledge Promotion 2020, termed Democracy and citizenship, Sustainable development and Health and life skills (Government, 2019).

Based on the chosen MOOC and academic year, the VTE students were given different

assignments. Students in class 1 were asked to create teaching for VET students based on the content of the chosen MOOC. At the end, the VTE students were required to write reflection notes about their *own* learning process (a-1). Simultaneously, VTE students in class 2 were tasked with writing 1-2 pages reflecting on the use of MOOCs to adapt education to individual VET students and enhance student-active teaching (a-2). The VTE students worked individually off-campus with the MOOCs and the relevant assignment, and received written feedback from their VTE teacher.

A new group of VTE students (class 3) received a brief on-campus introduction to the MOOCs. They were assigned to work in groups to create a digital story centred around one of the three interdisciplinary topics in the DIVE project. Individual work on the MOOCs was completed at home before a collective digital story was produced on-campus during the next study week. At the end of the semester, the digital stories were presented in plenum, followed by a three-hour World Café method session. World Café is based on essential design principles that stimulate student engagement through constructive dialogues, relationship building and collaborative learning. This method operates on the premise that students inherently possess the wisdom and creativity that is necessary to foster authentic dialogue. The aim is to stimulate collective thinking and the creation of actionable knowledge (Tan & Braun, 2005). In this study, a three-hour World Café session was conducted in which the VTE students discussed how and why to implement different digital tools in VET (a-3). In conclusion, each VTE student wrote a reflection note on how digital tools can contribute to differentiated instructions and student-active teaching for students in VET (b). In addition, all three classes were asked to reflect upon the potentials and limitations of MOOCs as a digital learning resource in VET and VTE (one page). These notes were written after VET students had engaged with MOOCs and completed associated assignments. The data material comprised these reflection notes, of which there were 100. A few VTE students in each class were not included in the study, due to a lack of consent. An overview of the participants, tasks and data material is summarised in Table 1.

Analysis

The data was analysed according to the steps in reflexive thematic analysis that were developed by Braun and Clarke (2022). First, the data material was uploaded to NVivo. NVivo is a tool for organising, systematising and analysing qualitative data (Alnap, 2020). To capture the essence of the VTE students' work and reflections, we started out with an inductive, open coding of the data material. After thoroughly coding the material, the data was categorised and sorted into sub-themes and more general themes. The themes create order in the data, enabling us to identify connections (Braun & Clarke, 2022). As we gained a greater understanding of the content of the empirical work, the themes were sorted into three overarching themes labelled: potentials, limitations and frame factors. Figure 3 illustrates an example of one of the three overarching themes with its associated themes and sub-themes.
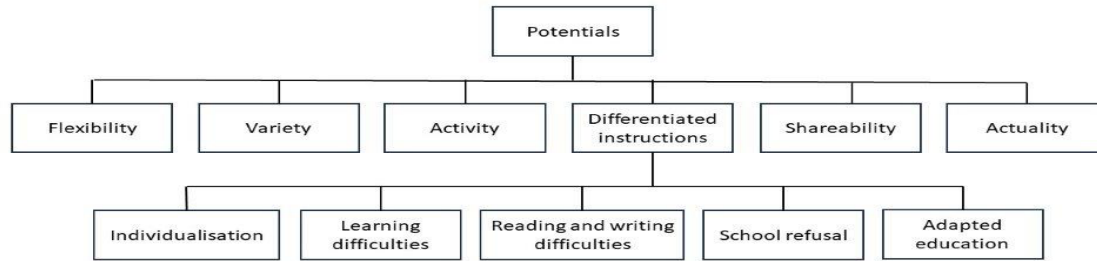
Figure 3. Example of one overarching theme together with its themes and sub-themes outlined in this study

Ethical considerations

The project was approved by the Norwegian Agency for Shared Services in Education and Research (SIKT; Ref. 649848). All participating VTE students provided their informed consent after receiving written information about the study's purpose, and being informed that they could withdraw from the study at any time, that their names would be anonymised and that the researchers would ensure confidentiality.

Both authors have been involved in the ERASMUS+ projects where the MOOCs were developed. Although we have tried to be open to the informants' experiences and perspectives, our preconceptions will always influence how we understand and interpret the data. Throughout every stage of the research process, we have discussed and reflected together, striving to make the research process as transparent as possible.

Moreover, the students' reflection notes are based on self-reporting, which makes them highly subjective. The participants' desire to present themselves in a certain way can affect the accuracy of the data.

We have placed emphasis on ensuring that it is not possible to recognise individual students' statements. Therefore, we have chosen to present the findings without referring to academic year, gender, professional background, or whether they were working in schools alongside their studies. We believe that this strategy of anonymisation does not reduce the validity but ensures that the students' statements and perceptions are protected against individual recognition.

Findings

This section presents the findings. Firstly, themes are presented concerning the potential of MOOCs as a learning resource in VTE and VET, generated from the perspective of VTE students. Secondly, themes that we identified as limitations are outlined. Finally, themes that might be either a potential or a limitation are described. These are termed frame factors and consist of students' and teachers' preconditions and economic resources.

Potentials

The potentials generated in this study are made up of the themes flexibility, variety, activity, differentiated instruction, shareability and actuality.

Flexibility

Flexibility emerged as a key benefit of MOOCs, according to most VTE students. Many VTE students highlighted the advantage of being able to access the course material at any time and from any location. As one VTE student noted: «The advantage of such online courses is that you can complete them without being physically present. You also can take the course when it suits you.» Another VTE student wrote: «The fact that the task is solved digitally makes the learning process more flexible, which is very positive for those of us who study alongside full-time work.» Appropriate pace is another potential that was pointed out by several VTE students. One VTE student wrote: «The MOOC is a useful tool in that you as a student can watch and go through the session at your own pace. You can also go back, pause and rewind if there is information you don't understand or don't catch during the first viewing.»

The VTE students also mentioned that MOOCs are flexible in relation to the way of working – whether the activity can be performed individually or together with others. Although the learning activity is moved out of the classroom, MOOCs offer opportunities for collaboration.

Variety

Variation is another potential that was highlighted by the VTE students, particularly regarding teachers' work with planning, implementation and assessment. One VTE student wrote: «MOOCs can provide teachers with increased knowledge about the various digital teaching methods available. By increasing this knowledge, one can have more varied teaching methods and less uniform teaching.»

What is also positive about MOOCs, according to one VTE student, is that: «There are so many opportunities in the use of these courses. The potential lies in the scope, which is clearly extensive and diverse.» In addition to variation in the planning and implementation of teaching, several VTE students mentioned different assessment situations. One VTE student wrote: «You can, for example, easily let the participants co-write and give peer assessment.» It was also emphasised that, through online courses, the teacher has a great opportunity to systematically give students continuous feedback and tell them what they can work on going forward.

Some VTE students thought that variety in using digital platforms can make the teaching more interesting for VET students. They believed that MOOCs, in combination with other learning activities, have potential. One VTE student wrote: «Finding a good balance and variation in approaches to VET is important as we encounter diversity in schools. VET students learn in different ways.» Some believed that using digital platforms makes teaching more interesting for VET students, and creates engagement and motivation for learning. One VTE student wrote: «In practice, I have observed that students often discover renewed motivation when exposed to a variety of digital tools, as many of them perceived competence and found it fun to learn.»

Activity

Activity is another potential of MOOCs pointed out by VTE students. One VTE student wrote: «It activates the learner as you actively have to watch videos and familiarise yourself with the topic.» Another VTE student wrote: «The same applies to students who are not particularly active in class, as they may prove to be more active by writing and documenting.»

A third student wrote:

> MOOCs makes it easy to implement films, competitions and problem-solving in a different
> way than with *non-digital* teaching – and thereby create high student activity. Students who
> attend VET often prefer to work practically, but this does not always mean hands-on. Practical
> can be understood in many ways as active, something digital tools can contribute to.

Another aspect, or subtheme, of activity is creativity. One VTE student provided a specific
example:

> An assignment where vocational students are required to create a digital story based on a
> chosen topic would give them countless opportunities. The assignment can be adapted based
> on their prior knowledge, both in terms of the production of the product and the theme. Such
> an assignment enables students to adapt, create and learn new things based on their existing
> knowledge.

Differentiated instructions

VTE students stated that there are several potentials in using MOOCs, related to differentiated
instruction, as well as adapted education. All VET students have different preconditions for
learning, and VTE students see several potentials in MOOCs being differentiated and/or adapted
to individual needs. One VTE student wrote: «MOOCs give us the opportunity to adapt tasks to
each individual VET student.» Another VTE student wrote: «MOOCs can attract students with
learning and concentration difficulties. A third wrote: «You have the option to pause or replay
the course, providing ample time for note-taking or revisiting sections that may not have been
fully grasped. This represents a notable advantage in the context of adapted and differentiated
education.»

Moreover, a fourth VTE student stated that: «Students with reading and writing difficulties
can insert audio and video instead of text. The fact that all text is read aloud is an advantage for
these students, as well as for foreign languages students.» Another VTE student stated that tasks
containing a significant amount of text can pose challenges for minority-language students. In
these cases, MOOCs can be a good supplement.

The VTE students also saw the potential of MOOCs for VET students with social anxiety or
school refusal. One VTE student wrote: «If, for example, it is a challenge to come to school,
one can work on it at home" and «For some with real school refusal, online courses can be an
alternative to help them keep up with the teaching.»

Another VTE student pointed to adaptation to high-achieving VET students and wrote:
«Students with high learning potential can further develop critical thinking» and «Teachers can
utilise MOOCs so that students have greater choices in delving into topics.»

Another VTE student wrote:

> Being given the opportunity to show their knowledge through more than oral and written words can help students gain better depth in their learning. Images, articles and film clips stimulate different part of the brain, thereby enhancing learning. This helps students to engage in higher-order thinking. By letting students work on their own presentations and professional development, the learning process itself is a good adaptation.

Shareability

A fifth benefit of MOOCs in VET is their potential to be sharable. MOOCs can be a good platform for sharing experiences, knowledge, ideas, assignments and other relevant subject matter. According to one VTE student: «It would be useful for students to share knowledge and learn from each other.» Several students emphasised that MOOCs served as a complementary addition to their existing learning activities. MOOCs can contribute to greater collaboration between schools, as well as between teachers, so that they can exchange ideas and teaching materials on a regular basis. Another wrote: «Especially for schools with small professional communities, this can help with ideas for teaching.»

The internationalisation of education is another aspect of sharing that VTE students identified as a potential benefit. One VTE student wrote: «By using online courses, you can create a good sharing culture in a broad sense and easily share experiences and knowledge, across municipalities, counties and even countries.» The VTE students pointed out that MOOCs open up opportunities for exchanging ideas, knowledge and experience across borders. One VTE student wrote: «You can have contact with schools in other countries and see how they work.»

Actuality

The actuality of the content in the online courses is a significant potential of MOOCs. The content provides both teachers and students from different levels, areas and programmes in vocational education with access to up-to-date knowledge, often from experts with specialised expertise. One VTE student wrote: «Since it's digital, you will constantly have access to new and updated information, compared to, for example books. Society is changing constantly, and it's not always the case that books keep up the same pace.» VTE students provided various examples of what they meant by this. It might be new ways of performing procedures or the results of new research that might show different results than current *valid* knowledge. VTE students expressed trust in the knowledge presented by such courses. One VTE student wrote: «As I see it, there will probably be courses of high quality, where individuals with expertise in the specific subject are the conveyors.» VTE students also believed that such courses are necessary in order to keep up with the times. One VTE student wrote: «In my field, developments occur rapidly and across numerous fronts, making it absolutely necessary to utilise such resources. They are crucial for updating VET teachers' knowledge but also for direct application in the teaching.»

VTE students also pointed out that the courses provide examples of updated ways to facilitate teaching and insight into digital artifacts. One VTE student wrote: «This is the first time I'm planning teaching based on the content of a digital online course. Such courses provide an entirely new approach to current methods of teaching.»

According to another VTE student:

> Students today are more familiar with digital tools than most teachers, and it's therefore important for teachers to stay updated in this area. School leadership should encourage teachers to stay updated and have an expectation of this. It's important for the school to be updated on what's relevant for the professions that the students will enter and to use tools the students will need in their future careers.

Limitations

The limitations generated in this study comprise the themes of interaction, relationship building, practical skills, tacit knowledge, *Bildung* and catchability.

Interactions

A significant limitation of MOOCs, as pointed out by many VTE students, is the absence of in-person social interaction between instructors and VET students, as well as among the VET students themselves. The important discussions that can take place in the classroom are prevented. One VTE student wrote: «A limitation of online courses is that you don't have the same opportunity for communication – for example, if there's something you want to be elaborated on or don't quite understand.» When MOOCs are conducted asynchronously, there is limited opportunity to ask questions in real time and receive immediate answers. Another VTE student wrote:

> A vocational school aims to provide students with practical training and understanding in their field. Most of them will enter professions where they will work with other professional groups and clients in private homes and public buildings. Being in a workshop and classroom for socialising with others in terms of behaviour, body language and physical collaboration is a significant part of the learning process that they carry with them into the workforce.

Relationship building

Many VTE students point out that the relationship between 'student' and 'teacher' is crucial for the student's learning outcomes. They believe that MOOCs can present a limitation to the development of a strong and personal connection between students and teachers. One VTE student wrote: «It could impact the close supervision, and at the same time, something happens mentally when you lose the social aspect. In the worst case, it could lead to dropping out of school because it will become too challenging for some.» Furthermore, the VTE student wrote that this vulnerability would be particularly pronounced for VET students who rely on the social aspect to learn.

Practical skills

Another limitation that was highlighted by many VTE students concerns the practical vocational skills. According to one VTE student: «There must be a focus on practical skills as well. Vocational subjects cannot be transferred to a screen, but they can be used as a complement.» Several VTE

students believed that online courses can never replace practical experience gained through direct interaction with people. This would be a limitation in terms of assessing and being able to apply knowledge in a context that provides a comprehensive understanding.

One VTE student provided this example: «Not everything can be learned by watching a video or doing tasks on a computer. In health and upbringing subjects, for instance, you must learn many skills where you have to perform them in practice.» The VTE student continued: «Therefore, it's important to emphasise that we must not replace physical practice, but rather include MOOCs or use digital tools as preparation for practice.»

Tacit knowledge

Another limitation highlighted by a VTE student is tacit knowledge:

> There's a lot of knowledge that I and others can acquire through such courses, but what specifically pertains to the profession in dealing with other people, I believe nobody can learn through such courses. There's a lot of tacit knowledge that can't be learned through books or the internet, but that can be acquired through extensive practice in dealing with other people.

Another VTE student pointed to finger dexterity as a vocational skill, and continued:

> In the hairdressing programme, they cannot learn everything by watching videos or performing tasks on various computer programs, etc. They must get their hands on hair and scissors to actually acquire the skills they need to master before they receive their trade certificate.

Bildung

One VTE student pointed out that using MOOCs in VET makes it more challenging for a teacher to contribute to students' *Bildung* processes. In addition, one VTE student wrote: «They need *Bildung* on how to behave online.» The rapid pace of technological development and digitalisation is something the VTE students were concerned about. According to one VTE student:

> Building attitudes about online safety becomes extremely important. As development progresses, opportunities for misuse arise regarding privacy and laws. We must teach our students to be critical of sources and to be aware of the consequences of spreading inappropriate information digitally, and most importantly, how to handle situations where this might occur.

In relation to VET students' *Bildung* and development of judgement, some VTE students described the teacher as a role model. One wrote: «It's important to wonder together with the students, while also always being a good role model. Prevention takes place through discussion, by asking open questions so that students can discuss and reflect.»

Catchability

According to one VTE student, it can be difficult for the teacher to identify signs of social challenges among VET students who extensively work from home. Another wrote that it becomes more challenging to observe students and their need for differentiated instruction when the teacher and student do not meet physically. One VTE student even wrote that MOOCs can pose a danger, because technology and digital tools can never replace the experience that students need through human interaction. This was explained as follows:

> For example, learning to interpret and address the body language and emotional, cognitive and physical needs of young children will never be adequately learned using technological and digital tools. This must be learned through gaining experience from interaction with real people in practice. You can work with the theory around this using various technological and digital tools, but it can never replace the practical experience gained through direct engagement with people.

Frame factors

This overarching theme comprises the themes of students' and teachers' preconditions, and economic resources. These can turn out to be both potentials and limitations in students' learning processes.

Students' and teachers' preconditions

Students' and teachers' preconditions are described as limitations as well as potentials. According to one VTE student: «Taking an online course requires that you are independent and self-regulated in the learning process.» MOOCs activate the learner, as they must actively log in to take the online course and engage with the topic. One VTE student stated that such courses make it easier to control how one wants to work with the subject matter, and continued:

> But at the same time, you depend on good self-discipline, as you decide how much you want to engage with the learning material and how much time you want to spend on the videos, etc. As an adult and part-time student, I found this to work.

However, some VTE students still thought that being addicted to good self-discipline or strong self-regulation can be a limitation: «It might be easy to just skim through the course without giving it enough attention.» According to one VTE student: «Weaknesses I can see in this are that you don't know whether students actually go in and watch the videos.» Another VTE student continued: «Students may need the teacher to provide extra explanations of the subject matter, and it's not guaranteed that everyone will understand or can follow the instructions through such a course on their own».

Moreover, VTE students' ICT competences can be both a potential and a limitation. One VTE student wrote that: «It can be a challenge if you don't understand what the teacher has set up, or if you don't have sufficient ICT knowledge.» Others pointed out that MOOCs can create digital divides: «If some students have far less experience of using digital tools than others, this

can be a significant disadvantage for those students. This can apply to students with immigrant backgrounds from developing countries, but also to ethnic Norwegian students.»

Similar to students' preconditions, teachers' preconditions can also be both a potential and a limitation. Some VTE students wrote that teachers must have strong professional digital competence. «All of this, with the use of digital tools, places demands on teachers. We must stay updated and know which tools are available, and most importantly, have an understanding of how they work and how they can be implemented in teaching,» wrote one VTE student, and continued: «Having this included in our education will be essential.» According to another VTE student: «I believe it's important that we, as future teachers, consider both the potentials and limitations of using digital tools, and that we practise so we become confident enough to implement them in the classroom and in teaching.» A third VTE student wrote that: «Some VET teachers might feel that they have little knowledge about the topic [digital learning resources], and therefore, they may consider it irrelevant. This is something that can influence the VET students as well.»

It is not only a lack of knowledge of digital tools or weak English skills that the VTE students identified as limitations; some also mentioned VET teachers' attitudes. One wrote that: «Potentials or limitations regarding the use of digital tools might mostly depend on the attitudes the VET teacher holds.»

Schools' and students' economic resources

The schools' and VET students' financial situations can represent either potentials or limitations. Financial conditions are linked to access to digital learning resources. One VTE student wrote that: «The school must have resources to provide all VET students with access to their own computer and internet», and continued: «When using such digital courses, there's also an expectation that VET students will have access to a computer and internet at home, which not everyone has.» According to another VTE student: «This can be a greater challenge for families with poor financial conditions and for minorities.» Finally, VTE students mentioned that reliable internet will be crucial for MOOCs being implementable at VET students' homes.

The findings summarised in Figure 4 illustrate the relationship between potentials, limitations and frame factors. The model aims to capture the inseparable relationship between the potentials and limitations of MOOCs as a learning resource in VTE and VET, and the students' and teachers' preconditions, as well as schools' and students' economic resources. In Figure 4, the characteristics of MOOCs are placed in the inner circle, surrounded by an outer circle denoting the frame factors. The dashed lines are intended to illustrate this inseparability.
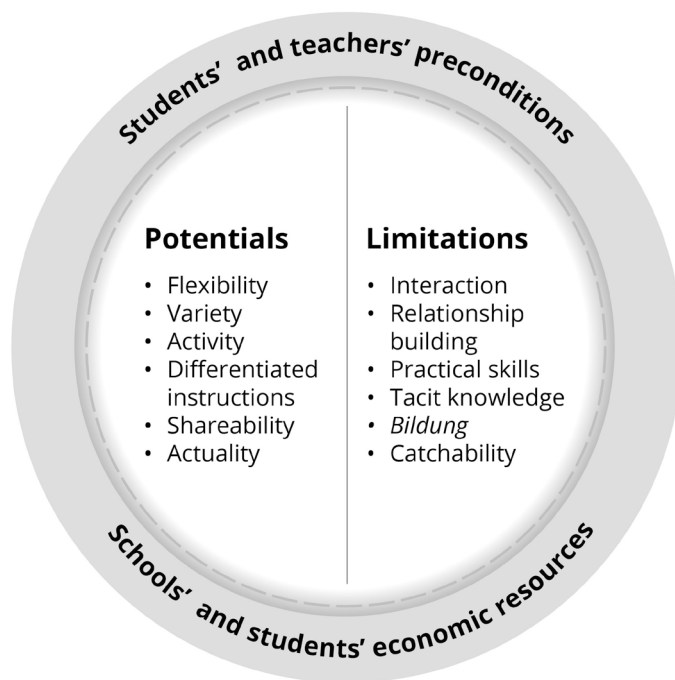
Figure 4. The relationship between potentials, limitations and frame factors of MOOCs as a learning resource in VTE and VET

Discussion

The discussion will delve into VTE students' perceptions of MOOCs as a learning resource in VTE and VET. Our findings, which are structured around the six areas of the DigCompEdu framework, provide a nuanced understanding of how MOOCs are viewed in terms of their potential to enrich and the limitations they entail. In addition, we will use the process model to shed light on how MOOCs can enhance VTE students' educator-specific digital competences. We begin with the four areas within the category of educators' pedagogical competences, before proceeding to educators' professional competences and learners' competences (Figure 1).

Digital resources

For all three classes, the MOOCs developed in the two ERASMUS+ projects served as the basis for VTE students' experiences, assignments and reflections. The MOOCs were exclusively used as online courses for class 1 and class 2, while for class 3, the MOOC was utilised as flipped learning. Regardless of the class, actuality is a sub-theme that was highlighted by several VTE students. They found the content to be pertinent, current and informative, and described how the exploration of the learning materials builds knowledge, skills and awareness.

As the MOOCs are digital, they can easily be modified and further developed. Consequently, the MOOCs provide VET students with access to *fresh and updated* information and knowledge, compared to resources such as books, and introduce new teaching methods, equipment and tools. These qualities might be particularly crucial for VET, as the subjects and occupations require continuous updating to meet the demands of the rapidly evolving job market. The use

of experts in the fields also contributes to actualising the content. MOOCs can thus provide unique access to modern knowledge and teaching methods that can enrich teaching. MOOCs are found to be a suitable method for the acquisition of up-to-date knowledge among university VET students in, for example, further education (Drake & Rajaorko, 2018). The choice of digital resources in education, and the planning of their usage, should be taken into account in the specific learning objectives, context, pedagogical approach and student group.

The framework also directs attention to the creation and sharing of digital learning resources (Redecker, 2017). In this context, VTE students emphasised that the economic resources of both schools and students play a critical role in determining the utilisation of MOOCs. This association is particularly relevant in terms of access to digital equipment and internet connectivity. For example, VTE students saw MOOCs as a limitation if VET students lack internet access or the necessary equipment.

Implementing VTE or VET MOOCs as a learning resource in internationally financed projects, such as we did in OPVET and DIVE, enhances the ability to secure the financial resources required to create MOOCs. It also increases opportunities for sharing and disseminating both the content and the experience. As Talbert (2017) points out, the materials developed in MOOCs can be converted into a flipped learning environment, as we did for class 3, which enhances the user interface. The educators do not necessarily have to create the videos, but instead curate them. By curating and sharing materials online or on-campus, the materials created by VTE students, their teachers or experts on various topics facilitate reflection, critique and renewal. As articulated by one of the VTE students who participated in this study, following their engagement with the Copyright and General Data Protection Regulation MOOC: «Thank you for teaching me about this!»

Teaching and learning

This area concerns managing and orchestrating the use of digital technologies in teaching and learning (Redecker, 2017). In accordance with previous research, flexibility is one of the most frequently mentioned potentials (Haber, 2014; Paton et al., 2018, Talbert, 2017). For VTE students, who often have family obligations and study alongside full-time work, flexibility concerning time and location are stated as being especially valuable. According to Talbert (2017), space does not necessarily solely mean physical space, but rather the physical, emotional, intellectual and psychological context that students encounter when they are studying. For VTE students with many 'beside school' obligations, MOOCs may provide some elbow room in their study situation.

Activity and variety are other potentials of MOOCs that were pointed out by VTE students. VTE students gave examples of various ways of being active: watching videos, commenting in Padlet, creating digital stories and writing blogs, as well as communicating and cooperating with students online. Through these activities, they had the opportunity for self-regulation, self-determination and involvement in their own learning process. The diverse ways of being active create variation. VTE students particularly highlighted variation regarding teachers' work on the planning and implementation of learning activities. According to VTE students, variety in digital learning activities, such as MOOCs, can make the teaching more interesting for VET students and consequently increase their engagement and motivation. The strengthening of students'

engagement and knowledge retention using MOOCs is particularly interesting for teachers in VET (Paton et al., 2018).

VET emphasises hands-on training and real-world application. VTE emphasises teaching planning, classroom management and relationship building. VTE students engage in practical exercises and workplace-based learning to develop the skills required for their chosen profession. MOOCs do not typically give hands-on training or highlight tacit knowledge. According to the VTE students, this is a limitation of MOOCs. They also pointed to the school's mission of *Bildung*. *Bildung* is a German concept (Zuurmond et al., 2023) that can be translated into English as *all-round development* (Government, 2019). *Bildung* involves the development of an individual's intellect, character and values, as well as their ability to think critically, engage with complex ideas and contribute meaningfully to society. It emphasises the nurturing of a well-rounded individual who is not only knowledgeable but also ethically and culturally aware. This concept reflects the idea that education is a lifelong journey that shapes a person's identity and their relationship with the world around them (Government, 2019; Zuurmond et al., 2023). The VTE students were aware that MOOCs do not necessarily provide the same opportunity for *Bildung* as in-person-interactions. One VTE student remarked: «VET cannot be moved to screens.» We see this as an expression of reflection, critique and renewal in the VTE students' learning process.

Assessment

Area 4 in the model addresses the use of digital strategies to enhance assessment, and concerns the use of digital technologies for both formative and summative assessment. Redecker (2017) states that digitally competent teachers should be able to use digital technologies in their assessment, to consider how these technologies can improve existing assessment strategies and how they can be used to create or facilitate innovative assessment methods. In the development project, all VTE students received feedback on their assignments and reflection notes (Table 1). In addition, the digital stories created by class 3 were part of their final exam. Based on these experiences, varied assessment methods and differentiated instruction were two potentials described by the VTE students. More specifically, the students gave examples of ways of practising formative and summative assessment using MOOCs, and how the content could be differentiated to each student. They believed that MOOCs can simplify the process of providing VET students with systematic and ongoing feedback, helping them to understand areas in which they can further improve. Digital technology can thus be used to follow up VET students' progress and facilitate feedback, so that VET teachers can assess and adapt teaching.

In light of the progression model, we can see that VTE students absorb new knowledge of assessment and refine their digital practices with a more structured approach.

However, Fernandez-Ferrer (2019) states that assessment is one of MOOCs' greatest limitations. In a study exploring VET teachers' digital competences with the DigCompEdu assessment tool, Cattaneo et al. (2020) found the assessment competence to be weakest among ten sub-scales. The explanation for this could be that assessment is based on pedagogical skills rather than specific digital competences.

Empowering *learners*

The use of digital technologies in education has important potential, as they can support learner-centred pedagogical strategies and promote students' active participation in the learning process (Redecker, 2017). This corresponds well with what many VTE students perceived as potentials of MOOCs. Creating Padlets, blogs and digital stories were activities they could choose. Many VTE students stated that working with such tasks gave them the opportunity to be active, self-determined, independent and creative. A study exploring Finnish VTE students' self-reported experiences in creating ePortfolios shows similar results (Korhonen et al., 2020).

VTE students gave several examples of how MOOCs can potentially differentiate the education programme. Learners can see and review the session at their own pace, and they can go back, pause and rewind if there is any information they do not understand. Furthermore, they saw potentials in MOOCs based on VET students' preconditions and needs. This includes differentiated instruction for all students and adapting education for students with different needs, such as reading, writing, learning and concentration difficulties. Another VTE student pointed out that minority-language students may struggle with tasks that include a lot of text. In that case, MOOCs can be an appropriate supplement. It was also mentioned that all text can be read aloud, which will be an advantage for students with such challenges, as well as how for students with school refusal, MOOCs may be an alternative for keeping up with teaching. Technology can support differentiated instruction by offering learning activities tailored to each student's level of competence, interests and learning needs (Redecker, 2017).

At the same time, it was mentioned by VTE students that MOOCs may not be appropriate for all VET students. Students with little self-discipline, motivation and/or self-regulation can just skim through the course without paying enough attention to it. This can affect the learner's learning outcomes and some students may also need extra guidance and support from the teacher, especially when it comes to more complex subject matter and independent work. Challenges related to weak self-regulation skills have been described in several other studies involving MOOCs (Alonso-Mencia et al., 2020; Korseberg et al., 2018; Perez-Alvarez et al., 2018). Therefore, it is important to acknowledge both the potential benefits and limitations when it comes to implementing MOOCs for educational purposes.

The VTE students stated that online courses do not provide the same opportunities for interaction and relationship-building with other students and teachers as on-campus teaching. They perceived this as a limitation. They strongly believed in the benefits of close contact and good relations between teachers and students. This limitation has also been highlighted by several education researchers (Bralic & Divjak, 2018; Lan & Hew, 2020). The VTE students also pointed to the importance of face-to-face interaction for teachers to be able to *catch up* students who are struggling. Well-functioning leaning platforms or communication channels become crucial in facilitating communication between students and teachers, as pointed out by the students. As Paton and his colleagues describe, feelings of isolation can be diminished if attention is given to the social interaction tools being utilised (Paton et al., 2018).

Empowering learning is highlighted in the VTE. The absence of fundamental prerequisites has significant implications for the relevance of learning and for student attrition (Evans et al., 2016). VTE students are rigorously trained in skills for planning and facilitating teaching, with a focus on accommodating the preconditions, needs and interests of VET students (cf. the assignments

the three classes were given (Table 1). We do not know if it is because the students' assignments specifically focused on tailored education, or if it is because they were particularly concerned with this issue due to their own needs (about half of the VTE students were in a teaching position alongside their studies), but in the area of empowering learners, we observe that the students were moving towards the apex of the progression model. The VTE students absorbed new knowledge, wrote that they developed basic digital practices, disseminated their insights with other VTE students and colleagues, critiqued existing practices by pointing to frame factors (e.g., teachers' preconditions, schools' economic resources) and shared that they developed new practices.

Professional engagement

The area of teachers' professional engagement is described within the category of educators' pedagogical competence. Professional engagement concerns teachers' ability to use digital technologies for their professional interaction with students, colleagues and other interested parties, for their own individual professional development and for the collective good of the organisation (Redecker, 2017). For VET teachers, this also includes the partners in working life. VTE students clearly appreciate both the significance and the importance of professional digital competence for future vocational teachers, and consider the possession of digital knowledge and skills to be essential requirements for teachers – for example, knowledge of what is available and legal, and the skill to be able to choose 'what to use' for which purpose. For this, continuous professional digital development is necessary, as the DigCompEdu framework highlights (Redecker, 2017). The ongoing professional development of educators will once again hinge on a combination of the school's economic resources, teachers' attitudes and willingness, and teachers' desire to pursue further growth, as pointed out by the VTE students.

The framework states that digital technologies have the capacity to engage educators in collaboration with other educators, sharing and exchanging knowledge and experience, and to collaborate innovative in pedagogical practices (Redecker, 2017, p. 36). The VTE students highlighted that MOOCs and digital tools make it easy for them to work together, and share experience and knowledge across municipalities and counties – and even countries. By creating digital stories, as students did in the ERASMUS+ projects presented in the introduction, VTE students also collaborate to innovate educational practices. Knowledge exchange across borders will provide the students with perspectives on their own learning, their *Bildung* and their identity, and demonstrate the value of cooperation across linguistic, political and cultural boundaries (Government, 2017).

Facilitating learners' digital competence

The rightmost area of DigCompEdu concerns facilitating the development of learners' digital competence through learning activities, assignments and assessments. The goal is for learners to master the ability to find relevant information and resources in digital environments, to organise and interpret this information, and to carefully assess the credibility of information and sources (Redecker, 2017).

The VTE students in this study believed it is important that teachers practice in such a way that they become confident enough to implement digital tools in their teaching. The VTE

students believed that the VET teachers themselves should have good digital competence, in order to facilitate teaching whereby VET students can develop their digital skills.

In the section dedicated to teaching and learning, we discussed the concept of *Bildung*, involving the development of an individual's ability to think critically. *Bildung* also includes digital judgement, which is essential for the responsible use of digital tools.

Teachers themselves must exercise digital judgement in order to facilitate the development of students' digital judgement. Therefore, knowledge of privacy concerns and how to manoeuvre correctly in the digital world will be essential for VTE students.

The VTE students also emphasised the importance of being a role model for VET students, based on both academic involvement and attitude-shaping work. In accordance with the curriculum, teachers must contribute to developing students' digital education and critical thinking (Government, 2017). However, VTE students pursue challenges for teachers in order to support VET students' *Bildung*, participation in democratic processes and cooperation via MOOCs. Digital common sense and critical thinking are important aspects, and VET students emphasised the importance of reflecting together, both with fellow students and with teachers. It will therefore be important that they learn to be critical of sources, so that they understand the consequences of disseminating inappropriate information digitally, as well as being trained to handle situations in which this may arise.

Krumsvik states that schools and teachers work well with the technical and practical aspects of ICT. At the same time, he points out that there is room for improvement when it comes to using digital resources in the subjects. There is often too much focus on how technology is experienced by users, and too little focus on what potential these resources can have for learning. A digitally inexperienced teacher would perceive the pedagogical opportunities as small, whilst a digitally competent teacher would see a multitude of pedagogical opportunities (Krumsvik, 2020). It is therefore important that this work starts in teacher education (Hjukse et al., 2020; Krumsvik, 2014; Tømte et al., 2013). The VTE students believed that MOOCs can aid vocational subject learning, including ICT, but cannot fully replace teachers in VET (Ramlo et al., 2018).

Conclusions

The aim of this study was to explore VTE students' experiences with MOOCs as digital learning resources in VTE. The study explores which potentials and limitations they perceive in MOOCs as a learning resource in VTE and discusses how MOOCs can enhance their educator-specific digital competences as outlined in DigCompEdu. The potentials described by VTE students include flexibility, variety, activity, differentiated instruction, shareability and actuality, whilst the limitations stated were related to interactions, relationship building, practical skills, tacit knowledge, *Bildung* and catchability. Frame factors, such as students' and teachers' preconditions and economic resources, were perceived as both potentials and limitations.

To summarise, the use of MOOCs as digital learning resources in VTE has many potential benefits, but also several limitations. Vocational teachers must be cognisant of when, where and for what purpose(s) MOOCs are beneficial. MOOCs cannot replace a physical presence in education but can be a valuable complement. To facilitate the development of VET students' digital skills, VTE students must develop, strengthen and raise awareness of their own

professional digital competence. Using the DigCompEdu framework therefore seems relevant, even if the framework does not take all characteristics of VET into account. The framework can assist VTE students as well as VET teachers in evaluating and enhancing their digital competences in the teaching context. In this study, we have seen VTE students move between all steps in the progression model, even though many spend the most time on the lower levels. They absorb new knowledge, develop basic digital practices, and apply and refine their digital practices with a more structured approach. VTE students also critically evaluated their own digital practices and wrote about how *new* knowledge had given insight and changed their practice. Their backgrounds and attitudes vary, and some have extensive experience with the use of digital technology both in their professional life and in their teaching job. In our view, the use of MOOCs as flipped learning (as we did in class 3) seems to be a good alternative if MOOCs cannot stand alone in a VTE programme.

Contributors

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