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Swedish vocational teachers' informal workplace learning during the initial phase of the COVID-19 crisis

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Abstract

As a result of the COVID-19 crisis, schools providing Vocational Education and Training (VET) around the world were largely forced to close and switch to Emergency Remote Teaching (ERT). This study deals with Swedish vocational teachers' informal workplace learning during the first three months of ERT. The purpose is to contribute knowledge about their informal workplace learning activities and the learning outcomes regarding professional knowledge about their teaching and the students' learning. Based on this purpose and theories of informal workplace learning, narratives were collected from 12 vocational teachers, of which 11 were written and one oral. The analysis of the narratives shows that the complexity of their work and their commitment to informal learning increased. The teachers' informal learning activities were characterised by increased collegial collaboration, increased reflection on the opportunities and limitations of ERT and increased creativity in problem solving. Furthermore, the analysis shows that the teachers' commitment to the social and practice-oriented informal learning activities contributed to increased pedagogical digital competence, expanded teaching repertoires, and an in-depth knowledge of the importance of learning environments for students' learning.

Keywords: COVID-19, emergency remote teaching, vocational teachers, informal workplace learning

Introduction

The COVID-19 pandemic has caused widespread health problems and social and economic disruption around the world. Important societal institutions and organisations have had to make major adjustments in their activities and the education sector has been significantly affected by the closure of regular educational activities (Bozkurt et al., 2020). For example, the United Nations (2020) reports that more than 1.6 billion students in more than 190 countries have been affected by the disruptions and shutdowns.

Extensive research has been, and is being, conducted into the consequences of the pandemic for schools and how the transition to Emergency Remote Teaching (ERT) (Hodges, Moore et al., 2020) has affected, for example, the teaching (Bond, 2020), pupils' and students' learning and motivation (e.g., Avila and Genio, 2020; Syauqi, Munadi and Triyono, 2020), teacher education (e.g., Kaden, 2020) and school leadership (e.g., Harris, 2020). Few studies, however, seem to address Vocational Education and Training (VET), which can be said to have been hit particularly hard by school closures, as a significant part of the programmes is practice-oriented.

This study deals with ERT in VET in upper secondary schools located in the northern part of Sweden. Vocational education constitutes a significant part of the Swedish upper secondary school system, both in regard to the number of students and number of programmes. In many countries, vocational education is a workplace-based apprenticeship education, while in Sweden, VET is predominantly school-based. The students study both profession-specific practical subjects and compulsory theoretical core subjects and undertake at least 15 weeks of work placement. Compared to other teachers, vocational teachers have more comprehensive duties as, in addition to their teaching duties, they are also important coordinators and links in the cooperation between school and working life (Gustavsson and Persson Thunqvist, 2018). Their work includes, for example, responsibility for ensuring that premises and specific professional equipment and machinery in school workshops and practice rooms are in good order, that safety rules are followed by the students and that practical and theoretical course elements are sufficiently comprehensive and of adequate quality to meet the curriculum's goals and the requirements of the labour market.

The attention of this study is focused on vocational teachers' informal workplace learning during the first three months of ERT. Studies on teachers' informal workplace learning, including learning activities and learning outcomes show, among other things, that it can contribute to increased professional knowledge regarding their subject knowledge, pedagogical knowledge and skills, and professional attitudes and identity (Kyndt, Gijbels et al., 2016). In comparison with formal workplace learning, informal workplace learning can be described as being situated and embedded in the daily work practice. It is manifested in activities and dialogues (Fenwick, 2009) and has a strong connection to problem solving and improvement measures (Tynjälä, 2008). Changes in work processes often result in employees' experience-based knowledge and skills being challenged, which means that new knowledge, skills and attitudes need to be developed in interactions between colleagues and with material objects (Boud and Rooney, 2018; Boud and Hager, 2012). This process of informal workplace learning can thus be described as social, practice-oriented and embodied. Based on this definition, it is

defined in this study as the informal learning that emerges when the vocational teachers try to transform and adapt the vocationally-oriented and school-based teaching to ERT in their daily workplace practice.

Current research on the consequences of the pandemic crisis for schools and the acute transition to ERT contributes to an increased understanding of their impact on teaching and learning in terms of structural, content, and pedagogical dilemmas and how these dilemmas were handled. It also identifies necessary areas for development, not least with regard to digitalisation and pedagogical development, in order to strengthen the schools' and teachers' preparedness for future educational changes. To meet these needs, increased formal training efforts for school staff may be one way to go, but as research shows, a large part of teachers' professional learning takes place through informal workplace activities focused on problem solving (Boud and Rooney, 2018). From this perspective, the transition to ERT in VET in the spring of 2020 can be described as a process in which the vocational teachers were involved in a comprehensive problem-solving phase, where they were expected to immediately adapt the vocationally-oriented and school-based teaching to ERT. This change was probably the greatest challenge they had ever faced, both in terms of integrating theory and practice into the ERT teaching and supporting all students' learning. This study is based on this transition process and with the support of the study's theoretical framework, which emphasises the connection between relational and practice-oriented problem solving and informal workplace learning (Fenwick, 2008; Tynjälä, 2008), the focus is on vocational teachers' informal learning in school practice during the first phase of ERT.

From this point of view, it becomes important to investigate vocational teachers' informal workplace learning and their informal learning activities in the workplace, such as collegial interaction and problem solving and interaction with material resources and tools, in order to understand how these activities can contribute to increased professional knowledge (Froehlich, Beausaert and Segers, 2015; Noe, Tews, and Marand, 2013). Given the challenges that the vocational teachers faced and the extensive adjustments they had to make to their teaching, it is also justified to make visible the learning outcomes of these informal learning activities, in other words, what the vocational teachers learned during their transition work from school-based teaching to ERT. Thus, the study covers two important aspects of vocational teachers' informal workplace learning, namely the learning activities and the learning outcomes. To explore these parts of the teachers' informal workplace learning, inspiration was taken from narrative as a method (Bamberg, 2012), as, in harmony with the study's theoretical framework, it emphasises the in-place actions and experiences of individuals and groups in practice. Based on these starting points and the narratives of 12 vocational teachers, the purpose of this study is to contribute knowledge about their informal workplace learning regarding learning activities and learning outcomes.

Theoretical framework and previous research

Informal workplace learning

As working life gradually changes as a result of increasing digitalisation, internationalisation, a rapidly increasing knowledge production and work reorganisations, the demands on, and interest in, workplace learning have increased. Competences at individual, group and organisational level must be constantly updated in order to deal with new challenges in an increasingly competitive society (Lecat, Beausaert

and Raemdonck, 2018; Tynjälä, 2008). Definitions of informal workplace learning emphasise the diversity of learning (Jacobs and Park, 2009) and its relational character, with individuals interacting with co-workers and cultural and material resources and tools. In other words, informal workplace learning is embedded within daily practice and is manifested in activities and dialogues (Fenwick, 2009). Tynjälä (2008) further points out the connection between informal workplace learning and the continuous task of dealing with new challenges and solving problems which together contribute to the development of practice.

Informal learning is often defined in relation to formal learning, which includes structured, standardised and goal-oriented educational activities (Marsick and Watkins, 2001). The purpose of such activities is often to train employees in new skills and competences needed in the workplace (Eraut, 2004), for example as a result of changes in work processes and methods. In recent years, such educational initiatives have to a large extent been linked to the digitalisation that is taking place in working life (Tynjälä, 2013). Informal learning, by contrast, is described as a situated and central part of work where employees' learning, in terms of new knowledge, skills and attitudes, develops in encounters with challenges and problems in daily practice (Boud and Rooney, 2018). In this kind of informal workplace learning, the intentional aspect of learning is emphasised, where the learner, by actively participating in practice, collaborating with colleagues, and solving problems advances their understanding of how the work practice can be improved (Tynjälä, 2008). Informal workplace learning also includes an unintentional and implicit aspect of learning where learning takes place, for example, through socialisation in a workplace (Eraut, 2004) or as a by-product of reflection on work (Marsick and Watkins, 2001). Examples of informal workplace learning identified in previous research show that learning can take place through collective and individual activities (Froehlich, Beusaert and Segers, 2015) and through interaction with non-interpersonal sources (Noe, Tews, and Marand, 2013).

Informal workplace learning is often described as a process of change that takes place within the worker and involves new knowledge, skills and attitudes linked to a specific professional practice. It can thus be seen as an embodied and, to a large extent, social process where learning through working with others and material objects emerges rather than is acquired (Boud and Hager, 2012). This view of workplace learning also means that professional practice is seen not only as a context for learning but also a place where practice and knowledge are mutually constitutive (Hopwood, 2016).

In definitions of teachers' informal workplace learning, the emphasis is placed on learning that takes place in their daily activities, which are often socially oriented and spontaneous (Kyndt et al., 2016) and where systematic support is not available (Hoekstra, Brekelmans et al., 2009). The majority of previous studies on informal workplace learning among teachers seem to be focused on learning activities. For example, in a review of 78 teacher studies, Kyndt et al. (2016) identify seven categories of informal learning activities, several of which are focused on teachers' social and material interactions. Examples of such activities are discussions, mentoring, sharing teaching tips, ideas and materials, observations by colleagues and testing tools and materials.

The learning outcomes of teachers' informal workplace learning are more difficult to identify due to their partly unconscious nature. However, in the light of previous studies, Kyndt et al. (2016) hold that such learning outcomes can be divided into the main categories 'subject knowledge', 'pedagogical knowledge and skills', and 'professional attitudes and identity'. It is shown, for example, that subject knowledge can be developed through digital media and in-depth literature reading (Henze, Van Driel, and Verloop, 2009), and pedagogical knowledge and skills through collective activities that lead to improved teaching methods (Hoekstra et al., 2009), pedagogical teaching skills (Kang and Cheng, 2014) and technical skills (Van Eekelen et al., 2006). In the category 'professional attitudes and identity', it has been shown, for example, that teachers' informal learning can contribute to increased self-esteem (Henze et al., 2009) and increased awareness of what may influence students' and teachers' behaviours (Hoekstra et al., 2009).

Emergency Remote Teaching

In the literature, many different concepts are used for distance-based teaching and learning during the pandemic (Bond, 2020), e.g., online learning / teaching / education and remote teaching / learning. The concept of emergency remote teaching indicates that the pandemic crisis led to an acute transition from school-based to distance-based teaching. However, ERT should not be compared with established distance-based forms of education that have been developed and tested over time and which in the literature is generally judged as being of high quality (Hodges et al., 2020). This study uses the term 'emergency remote teaching', as it focuses on vocational teachers' informal workplace learning during the first few months of the pandemic. However, in the account of previous research below, the authors' original concepts are used.

In the literature, teachers' digital competence is discussed in terms of knowledge, skills and attitudes and described as an open, curious, and holistic approach to IT, rather than the ability to use a particular digital technology. Examples of concepts are Krumsvik's (2014) 'professional digital competence' and From's (2017) 'pedagogical digital competence' where teachers' digital competence is integrated with their pedagogical competence in teaching practices. The latter concept is used in this study, as it includes both technical and pedagogical aspects of teaching.

The closure of schools and the transition to emergency remote teaching as a result of the onset of the COVID-19 pandemic are currently being studied from a variety of perspectives and at different levels with a view to increasing the understanding of its consequences for pupils, parents, students, teachers, school leaders and society as a whole. At the societal level, for example, attention is paid to IT infrastructure and education policies in different countries (Bozkurt et al., 2020; Kerres, 2020) and at the school level, for example, on the function and significance of school leadership (Harris, 2020), teachers' IT readiness (Gudmundsdottir and Hathaway, 2020), teachers' challenges in teaching (Bond, 2020; Kaden, 2020), teachers' professional development (Hartshorne, Baumgartner et al., 2020) and student motivation and learning (Avila and Genio, 2020; Syauqi, Munadi and Triyono, 2020).

From a student perspective, both Avila and Genio (2020) and Syauqi et al. (2020) suggest that students' motivation for learning could be maintained through digital support during the initial period of the

pandemic. In addition, the latter study shows that the vocational students in the study perceived that online learning facilitated their learning but did not offer better opportunities to master skills.

In their study, Gudmundsdottir and Hathaway (2020) draw attention to teachers' IT readiness in Norway and the USA. For example, it is shown that most teachers lacked experience of online teaching prior to the pandemic, but that the vast majority were positive and willing to learn new ways of teaching with the support of digital technology. Furthermore, many studies focus on the teaching challenges that teachers had to deal with. For example, it is shown that their workload increased (Kaden, 2020; Bond, 2020), not least due to the students' increased need for support structures and measures (Bond, 2020). In line with this, Kaden (2020) holds that online education can support students' learning if it is adapted to their different learning abilities. Teacher students' learning and professional development during the initial period of ERT have been studied by Hartshorne et al. (2020), who show that the students' participation in communities with a focus on professional development can give them increased opportunities to develop their digital and pedagogical skills and their attitudes as teachers.

Based on this review of the study's theoretical framework, and previous research on teachers' informal workplace learning and on ERT, the study's research questions are the following:

1. What are the characteristics of the vocational teachers' informal learning activities in school practice during the first three months of ERT?
2. What informal learning outcomes that contribute to the vocational teachers' professional knowledge about teaching and students' learning can be identified in their narratives?

The first question is based on the study's theoretical framework and thus assumes that the vocational teachers' informal workplace learning is situated and embedded in their daily work at school (cf. Boud and Rooney, 2018). It is also based on the assumption that the vocational teachers' informal workplace learning is manifested in daily informal learning activities and dialogues (cf. Fenwick, 2009), which, in this case, take place with a view to adapting vocationally-oriented and school-based teaching to ERT. Furthermore, the question has a clear connection to previous research on teachers' informal learning activities in school (cf. Kyndt et al., 2016), and its focus on VET and ERT means that more teacher categories and examples of problem-solving activities can be added to the research field.

The second question is also based on the study's theoretical framework, which means that the vocational teachers' informal learning activities in connection with the transition to ERT are assumed to lead to the emergence of new professional knowledge and skills (cf. Boud and Hager, 2012). It also has a clear connection to previous research (cf. Kyndt et al., 2016) showing that teachers' informal learning in school can contribute to the development of their subject knowledge, pedagogical knowledge and skills and professional attitudes and identity.

Finally, both questions have a certain connection to studies on the consequences of pandemics and on ERT which, for example, treat of teachers' perceptions of challenges in teaching (Bond, 2020; Kaden, 2020), students' learning and motivation (Syauqi et al., 2020) and teacher students' professional development (Hartshorne, 2020). However, studies focused on teachers' informal learning in connection with their work to implement ERT appear to be sparse, which justifies the focus of this study.

Method

Study setting

The study involves vocational teachers qualified to teach one or more vocational subjects. Their work consists of teaching vocational students, usually aged between 16 and 19 years old, in the theoretical and practical parts of the subjects. The teaching is usually carried out in groups of about 8-16 students in workshops, practice rooms and traditional classrooms and teaching sessions usually last several hours. In addition, the vocational teachers are responsible for coordinating students' placements at various workplaces and providing them with conditions that facilitate the integration of theoretical knowledge and practical skills in the school-based and workplace-based parts of the programmes. The teachers who participated in this study work at upper secondary schools located in small communities and cities in the northern part of Sweden. The number of students at these schools varies between 400 and 1000, and, depending on the size of the schools, the range of available vocational programmes and the number of vocational teachers in each programme also vary.

Participants

The selection criteria were that the participants should be practising vocational teachers, have qualified teacher status in their vocational subjects and have at least three years of teaching experience from one of the 12 upper secondary vocational programmes. All twelve participants in the study met these criteria. The vocational teachers' background variables are shown in Table 1.

Table 1: An overview of the vocational teachers' background variables.

Vocational programme	Number of teachers, age and teaching experience
Health and Social Care	Three female teachers. Age: 47, 52, 54. Teaching experience: 9, 14, 15 years
Industrial Technology,	Three male teachers. Age: 33, 48, 61. Teaching experience: 3, 11, 23 years
Vehicles and Transport	Two male teachers, one female teacher. Age: 49, 50, 43. Teaching experience: 10, 12, 9 years
Building and Construction	One male teacher. Age: 46. Teaching experience: 11 years
Electricity and Energy	One male teacher. Age: 48. Teaching experience: 12 years
Hotel and Tourism	One female teacher. Age: 55. Teaching experience: 7 years

As shown in Table 1, six out of 12 Swedish vocational programmes were represented, and seven men and five women participated in the study, most of whom were between 45 and 55 years of age and had more than 10 years of teaching experience.

Data collection methods

Given the content of the study's questions and their open-ended nature, and the assumption that the vocational teachers were actively involved in the work with ERT, it was considered necessary that they be given time to reflect on their school experiences, on how they had dealt with the challenges

encountered and what they had learned in their work with ERT. The design of the data collection was inspired by narrative as method as, in harmony with the study's theoretical framework, it emphasises individuals' and groups' in-place experiences (Bamberg, 2012). The vocational teachers were asked to reflect on their participation in the daily work with ERT. Furthermore, they were asked to reflect on what they had learned as teachers regarding their own teaching and the students' learning during the transition period to ERT.

Procedure

An e-mail was initially sent to 25 vocational teachers working in the northern parts of Sweden. The attached cover letter contained information about the study's purpose, the research questions and selection criteria, and information about narrative as method. Furthermore, the teachers were informed that their participation was voluntary, that the study was part of a research project and that all information in the collected data material would be treated in a confidential manner. In view of the teachers' work situation, they were given a choice between submitting their narratives either in writing or orally in a recorded online session. Of the 12 teachers who participated in the study, 11 chose to write a narrative comprising between four and six A4 pages. The online recorded session lasted for 50 minutes.

Data analysis

Initially, reading and rereading of the transcripts were conducted in order to get a first overall picture of the narrative material. The material was then categorised, coded and thematised in several steps with inspiration from Kvale and Brinkman (2009) and Braun and Clark (2006). In the first step, sentences and sections in the teachers' narratives were categorised and each category was marked with an initial code such as 'reflection on digital tools', 'discussion about teaching methods' and 'thoughts about students' learning'. In the subsequent analysis (step 2), a category map was drawn up (cf. Braun and Clark, 2006), which revealed several categories with a similar content, many of which could be merged, which resulted in a reduction of the material. For example, after careful comparison between the above-mentioned categories and other similar categories, they could be merged into the theme 'Reflection'. This analysis continued until no new categories could be identified (Kvale and Brinkman, 2009). Next, the identified themes were sorted on the basis of the study's questions about the vocational teachers' informal learning activities and the informal learning outcomes regarding their teaching and knowledge of the students' learning (step 3). Finally, the study's theoretical framework with concepts such as informal learning activities, informal learning outcomes and professional knowledge and skills was the central analysis tool for increasing the understanding of the vocational teachers' informal learning. In this part, the material was analysed with a special focus on the social, practice-oriented and embodied aspects of their informal workplace learning (cf. Boud and Rooney, 2018; Boud and Hager, 2012; Tynjälä, 2008).

Findings

This section is structured according to the study's questions, where the first one deals with the vocational teachers' informal learning activities and the second one with identified informal learning

outcomes. Under the headings, '*Informal learning activities*' and '*Informal learning outcomes*', the identified themes are presented.

Informal workplace learning activities

In the vocational teachers' narratives about their work with ERT, three themes can be identified regarding their informal learning activities: expanded collegial collaboration, increased reflection on the opportunities and limitations of ERT and increased creativity in problem solving.

Expanded collegial collaboration

The informal collaboration with colleagues in the work teams seem to have gradually increased during the ERT period, even though a couple of the vocational teachers who have only a few colleagues claim the opposite. However, the vast majority, most of whom work in larger teacher teams, describe that the collaboration and exchange of experience increased. "We have seen a huge increase in collegial collaboration. The ideas shared both at school and in various forums on the internet are endless" (Health and Social Care, teacher 3). The vocational teachers' collegial collaboration seems to have been largely focused on the shortcomings and problems they identified at the beginning of ERT. These were, for example, deficient task instructions, teaching materials that were not digitalised and teaching methods that were not adapted to digital learning environments. In relation to these identified shortcomings and problems, most teachers describe how they shared their experiences of ERT, shared teaching materials, discussed solutions that could improve the remote teaching and helped each other through tips and advice. "We help each other to find new paths and we share teaching materials. We discuss alternative solutions" (Industrial Technology, teacher 1). Several vocational teachers also state that their collaboration with colleagues outside the work team increased, especially with the student care teams who could help to individualise the support to students. For example, it was a matter of improving the language and technology support for the students with the help of special education teachers. "We collaborate more with the student care team who can provide individual support to students with special needs" (Health and Social Care, teacher 1).

Increased reflection on the opportunities and limitations of ERT

The second theme is that the vocational teachers' individual and collegial reflection on teaching and students' learning seems to have increased as a result of the transition to ERT. Many teachers state that when they switched to ERT and saw the effects of it, they gradually began to reflect more and more on the choice of methods and tools they made. For example, they report that they reflected to a greater extent than before on which teaching methods were appropriate in relation to the subject content and how digital technology could best facilitate the students' learning. One teacher describes the situation in these words: "We have spent a lot of time reflecting on the choice of methods for each phase of the teaching and I have thought a lot about how to make the students see that digital technology is a support to their learning instead of something to be afraid of" (Hotel and Tourism, teacher). Other teachers mention that, at the start of ERT, they often reflected on the limitations of using remote teaching in upper secondary vocational education, as it is largely about learning how to interact with machines and tools in different work processes. One teacher states that it is about "transferring students' theoretical knowledge into practical skills and this is difficult to do at a distance" (Building and construction,

teacher). However, as teachers gain more experience of ERT and reflect on it in the work teams, their focus seems to be gradually directed more and more towards the opportunities for integration of theoretical and practical elements offered by the digital learning environments. Some of these teachers describe how their joint reflections resulted in alternative ways of looking at the implementation of the practical teaching. "After all, a lot can be done in a different way. For example, to be able to have more distance lessons where we can use the technology to show work processes and discuss these with the students. I think we could use this a lot more" (Industrial Technology, teacher 3).

Increased creativity in problem solving

The third theme, increased creativity in problem solving, is closely linked to the second theme. Many teachers' descriptions of how the individual and collegial reflection increased during the initial ERT period are often followed by accounts of how it resulted in creative and alternative teaching solutions that could replace the practical exercises in school and support the students' theoretical understanding. One teacher reflects on this change: "I have worked really hard to find creative solutions that appeal to the students. In this work, the production of material has been essential for a successful outcome" (Health and Social Care, teacher 1). Other teachers describe how they increasingly explored and learned about the schools' LMS and video conferencing systems and that they realised that they could combine the use of these with other subject-specific digital programs for teaching and assessment, teacher guidance via digital smartboards at school and telephone contacts. One teacher describes the combined solutions they developed in the following manner: "We used our video conferencing system to set up group rooms, share documents and provide guidance. We work with CNC technology and the students programmed their settings via CAD programs that we teachers programmed into the machine so that the students could see the results via a video conferencing" (Industrial Technology, teacher 2). Another teacher, working on the same programme (teacher 3), explains how they combined work in different LMS with joint writing surfaces, examination programs, digital course materials and support functions such as reading services. Some other teachers describe how they discovered that they could collect students' work in the form of texts, pictures and videos on a platform in order to make the students' knowledge progression more visible. According to these teachers, this gave them better opportunities to individualise the support and guidance for each individual student.

Informal workplace learning outcomes

This part of the findings is divided into two sections. The first section, which deals with informal learning outcomes relating to teaching knowledge and skills presents the two themes identified, namely *Increased pedagogical digital competence*, and *Expanded teaching repertoire*. The theme *Increased understanding of the importance of learning environments*, which deals with informal learning outcomes as regards the teachers' knowledge of students' learning, is presented in the second section.

Teaching knowledge and skills - increased pedagogical digital competence

During the rapid transition to ERT, it turned out that the digital competence varied greatly between teachers, vocational subjects and schools, from analogue, classroom-based teaching where digital technology was primarily used for administrative purposes, to schools and subjects where learning management systems (LMS) and digital tools in teaching had already been implemented. As expected,

all vocational teachers, regardless of previous experience, emphasise that their work on implementing ERT broadened and deepened their digital competence. "We have learned a great deal about digital tools and how we can use them in more ways than we have done so far" (Health and Social Care, teacher 1). For example, one teacher tells of how they "learned to make films where we show the students how things work in practice" (Vehicles and Transport, teacher 2), and another how they "learned to share links to 1177 (a net-based National Health Advice site) and YouTube clips on, for example, blood pressure measurement" (Health and Social Care, teacher 2).

Many teachers also describe that, over time, the pedagogical aspect of digitalised teaching became increasingly prominent in the teacher's team discussions. For example, it is described that "all the teachers were very good at immediately sending out homework to the students, but the fact that it was done in several different ways created confusion among the students. Gradually, through intensive dialogues between colleagues, we developed common strategies for how to set up the teaching" (Industrial Technology, teacher 2). Furthermore, one teacher states that "I am always available on the platform during the lessons, because we have realised that this solution gives the students a better feeling of taking part in a physical lesson compared to when they work entirely on their own (Vehicles and Transport, teacher 1). Another result of the teachers' collective informal learning was that more vocational subjects were digitalised, which meant that they could be varied and broadened to a greater extent (Industrial Technology, teacher 1). In several narratives, teachers also point out that the informal learning during the transition period contributed to strengthening their generic competencies, such as increased ability to seek information and to solve problems with the support of digital technologies. "Of course, we have learned a lot during this time about the opportunities provided by digital technology in teaching, which will benefit us teachers and, in the longer term, our future students" (Health and Social Care, teacher 3). As an example of the connection between the teachers' development of their pedagogical digital competence and teaching, one teacher expresses that she wants to use these competencies in teaching by "providing students with much more training in searching the Internet, navigating LMS and creating folders to save documents" in the coming school year (Hotel and Tourism, teacher).

Teaching knowledge and skills - expanded teaching repertoire

The teachers often return in their narratives to the complexity of the task of integrating theory and practical elements into the school-based teaching, organising the teaching so that all students can have the support they need to meet the educational goals, and organising the workplace-based part of the programme so that it strengthens the professional competence development of all students. The partial school closures therefore became an extremely difficult challenge as the opportunities to carry out the practical modules in school and in the workplaces were severely limited. The teachers describe how they, together with their colleagues and with the aid of digital technology explored, tried out and learned about ways to reorganise the teaching. Their learning resulted in solutions where theoretical course elements were taught via LMS, videos describing practical work processes were produced and school-based elements were introduced where small groups of students came to the school to carry out more advanced practical tasks. One teacher describes the solutions that his teaching team devised: "Some

practical teaching is conducted in the field and small groups of students do practical assignments at the school. The other groups are taught via LMS. It is quite difficult because we usually go through the theory first and then proceed to the practice. Therefore, we have now produced videos that show the students how a particular job is done in practice. At the end of the semester, two students at a time come in and do practical tests (Vehicles and Transport, teacher 3). Another teacher states that digital technology was an important support in the theory-based teaching even before the pandemic, but that his teaching team had now also learned how to develop digital solutions to teaching practical course elements at a distance. "Fortunately, large parts of our teaching were already done online, but the practical course modules have been a problem. We solved some problems by stowing a bunch of computers into my car and going to the students' homes so that they could do the mechanical and technical skills tasks required by the syllabus. It has worked very well" (Industrial Technology, teacher 1). Other teachers describe how they learned how to handle the lack of practical applications of theory by revising and digitalising previous teaching materials, recording instructional videos, designing practical tasks that could be done at home, creating cases that students worked with in groups and developing synchronous discussion forums where students gave and received feedback from their fellow students.

Knowledge of student's learning – Increased understanding of the learning environment's importance for learning

In their narratives, teachers often return to the fact that during the ERT period, they gradually increased their understanding of how the learning environments affected their students' learning. They describe how they gradually became aware of the similarities and differences between school-based teaching and distance-based teaching and that some student groups seemed to benefit from the digitalisation of the learning environment, while other groups did not. The teachers provide many reflections on how they realised that ERT seemed to favour those student groups which in regular school-based teaching performed well in theoretical learning contexts, students who needed calm and a well-structured study environment, and quiet students. They describe how these students' learning and performance in the ERT environment have been positively affected by the fact that the theoretical parts were expanded at the expense of the practical ones, that the ERT environment contained fewer distracting elements and that the teaching became more individualised. Three teachers share the lessons learned : "I find that quiet students tend to talk more in front of a webcam than in a classroom" (Electricity and Energy, teacher), "The students who have problems sitting with other students have been given a quieter environment, which makes it easier for them" (Building and Construction, teacher), "Some students have performed much better in home studies, in particular one student who had great problems fitting into the study group and who was constantly in conflict with others. This student has become much calmer and more focused on the tasks" (Industrial Technology, teacher 3).

Similarly, the narratives reveal that the teachers also increase their understanding of why the ERT environment seemed to affect the learning and performance of certain student groups in a negative way. Among these students, who some teachers describe as being disadvantaged in the ERT environment, are practically-oriented students and students with Swedish as their second language.

According to one of the Health and Social Care teachers, she became quite quickly aware that students “who have difficulties with the theoretical parts of the courses but have good practical abilities (dexterity, attitude, empathy) are the biggest losers in remote teaching, as they get fewer opportunities to demonstrate their practical skills” (Health and Social Care, teacher 3). The Health and Social Care teachers further describe how they almost immediately realised that most second language students, many of whom study on the nursing programme, missed the physical classroom environment where they could easily receive subject, language and technical support from their teachers and fellow students. In dialogues with the students, the teachers realised that the students’ motivation for school work decreased over time, which resulted in the teachers having to “work a lot harder to motivate my immigrant students, who want classroom teaching” (Health and Social Care, teacher 1).

As the vocational teachers after a while identified a gradual downward trend in the students' motivation for learning and school performance, they describe how they became aware of other important parts of the learning environment that affected the students' learning. These parts are addressed in all teachers' narratives where they describe in different ways how they realised the importance of maintaining the routines in schoolwork, providing clear and accurate instructions, and creating a sense of participation and security. Based on these lessons learned, the teachers describe how they designed different strategies in their work teams. The first strategy was to maintain as many of the school-based routines as possible through continuous reviews of timetables, lesson plans and assignments and clear introductions and conclusions to lessons. The second strategy was to improve the clarity of communication. Many teachers used several different ways to make information available to reduce the risk of misunderstandings. One teacher had learned that “in teaching via video conferencing, lessons must have a clear start and end point”, and that “after a short and clear introduction, I let the students work on their own and then we gather for discussions and questions. This solution gives students the feeling of taking part in a physical lesson” (Vehicles and Transport, teacher 3). Some other teachers point to the difficulty of engaging students in online discussions, which meant that the teachers had to try new ways of asking questions and encouraging students to participate in the dialogue. The third strategy, which many teachers thought was very important to learn more about and develop, was to create a digital learning environment where students feel involved and safe. For example, several teachers mention how they intensified dialogues with absent and low-performing students in order to increase their understanding of these students’ needs and to try to adapt the teaching together with the students. The teachers give several examples of how this work became an important support for students' learning: “The interesting thing for me is that I have now managed to create a deeper relationship with students that I have not been able to reach before. However, with some other students, the opposite has been the case” (Health and Social Care, teacher 1), “I have extended my mentor dialogues to two times a week to keep the group together, and the students think this is useful” (Vehicles and Transport, teacher 1), “I work hard to create dialogues to drive the teaching forward. It works very well via video conferencing, sometimes even better than in the classroom” (Building and Construction, teacher).

Discussion and conclusions

The purpose of this study was to contribute knowledge about vocational teachers' informal workplace learning during the first phase of ERT. The study, with its focus on vocational teachers' informal learning activities and informal learning outcomes at their workplaces, is a complement to the extensive research that is currently being carried out on other teacher groups' experiences of teaching and learning during the pandemic crisis.

Overall, the analysis shows that the immediate closure of the schools resulted in major challenges to the vocational teachers' opportunities to conduct teaching (cf. Gudmundsdottir and Hathaway, 2020; Bond, 2020; Kaden 2020), not least when it comes to implementing practical course elements and integrating theory and practice. The situation can thus be described as the teachers being involved in an extensive problem-solving process (cf. Boud and Rooney, 2018; Tynjälä, 2008) that included several didactic, pedagogical and technical challenges which they had to deal with in order to be able to develop adequate remote teaching. It is shown that, as a result of this challenge, the vocational teachers' active involvement in informal learning activities is increasing and that several informal learning outcomes regarding professional knowledge and skills can be identified.

The analysis of the teachers' informal learning activities shows that these activities are characterised by increased collaboration and dialogues between colleagues, by increased reflections on which teaching methods and tools may be suitable to use in relation to a particular subject content and, in many cases, by creative attempts to design alternative teaching arrangements (cf. Kyndt et al., 2016).

The social aspect of learning (cf. Froehlich et al., 2015) is quite evident in the teachers' narratives about how their collaboration within the teacher teams and with the special education teachers was gradually strengthened. In the teachers' work of dealing with the challenges that ERT entailed, collegial learning was becoming increasingly important, which is shown by the fact that the exchange of experiences and support between the teachers increases (cf. Kyndt et al., 2016). There was a development from individual attempts by the teachers to find their own stop-gap solutions to collegial collaboration where they devised collective and more sustainable solutions. However, it should be mentioned that the two teachers who only had a few colleagues expressed that the collegial collaboration decreased, which indicates that the size and composition of teaching teams and teachers' previous experience of collaboration may affect the opportunities to develop collegial collaboration.

The informal learning activities are further characterised by a practice-oriented learning (cf. Marsick and Watkins, 2001), which is shown by the teachers' increasing reflections, individually and together with colleagues, on the affordances of digital technology and how these could be used to achieve their didactic and pedagogical intentions in teaching. In other words, this process of reflection was about how subject content, teaching methods and digital tools could be combined to achieve a remote teaching that benefited the students' learning.

Furthermore, the embodied aspect of informal workplace learning (cf. Boud and Hager, 2012; Hopwood, 2016) is made visible in the teachers' exploratory activities where they gradually, and with the support of each other, tried out technologies in their teaching which were new to them. As their digital

competence increased, it is also shown that several teachers developed creative teaching arrangements where their pedagogical intentions were translated into new ways of combining different digital technologies and integrating theory with practice. This development towards the teachers themselves designing creative digital teaching solutions shows that they also developed their own pedagogical digital competence (cf. From, 2017). In the analysis of the informal learning outcomes regarding teaching, the following two partly interrelated themes can be identified: increased pedagogical digital competence and expanded teaching repertoire.

The social and embodied aspects are present in the teachers' informal learning (cf. Boud and Hager, 2012; Hopwood, 2016), as some teachers with poor digital skills, together with others, learned to interact with digital technology, while other teachers deepened their digital skills (cf. Van Eekelen et al., 2006) by discovering new affordances provided by digital tools. As shown in the results, this learning outcome was manifested by the fact that more vocational subjects were digitalised and that teachers in several different subjects deepened their understanding of how to integrate theory and practice with the support of digital technologies. In the long run, it is reasonable to assume that this learning will contribute to strengthening the teachers' professional knowledge and skills in terms of their being able to vary the teaching, but, above all, to make informed choices of teaching arrangements that can benefit the students' learning.

Collegial communication and reflection, as well as interaction with students about the opportunities and limitations of ERT in relation to their needs, seem to have contributed to the pedagogical aspects of teaching becoming increasingly important. As a result of these interactive processes, joint pedagogical strategies were designed, and theoretical and practical elements were integrated, which together contributed to the teachers being able to broaden their teaching repertoire. With the support of, for example, asynchronous and synchronous digital technologies, self-produced videos and individual dialogues with the students, they developed alternative ways of organising the practically-oriented teaching. The teachers' expanded teaching repertoire (cf. Kyndt et al., 2016) reasonably means that their professional development was strengthened and that, as some teachers claim, it will also contribute to the development of VET in the long run.

In the analysis of the informal learning outcomes regarding knowledge of students' learning, the theme 'increased understanding of the importance of the learning environment' can be identified. The introduction of ERT meant drastic changes for teachers (cf. Gudmundsdottir and Hathaway, 2020), as their pedagogical knowledge and skills in instructing and supervising students in practice environments and communicating face-to-face with students about their learning, vocational skills and well-being were not immediately transferable to ERT. However, the analysis shows that the teachers' growing awareness of the importance of the learning environment for students' learning and different needs for support (cf. Hartshorne et al., 2020) became a driving force for increased social and relational learning (cf. Hoekstra et al., 2009; Kyndt et al., 2016). In dialogues within the teacher teams, with special educators and with students, the students' needs were identified, both at individual and group level. At the group level, the teachers found that the digital learning environments in ERT seemed to benefit certain student groups' motivation and learning, while the opposite was true for other student groups.

Based on this expanded knowledge of the students' learning, the results show that the teachers developed similar and 'normalising' ERT strategies, which emphasised the importance of routines, clear communication and safe and secure relationships. These aspects are probably relevant to consider in all learning environments and the strategies were thus necessary in order to create stability in ERT. However, given that the learning of the student groups was affected in different ways by ERT, it can be stated that the teachers' awareness of this did not lead to any specific strategies to meet the different student groups' needs during the initial period of ERT. However, their knowledge of students' learning is a central part of their professional learning as teachers, which will enable them to adapt their teaching to students' different needs for learning support in the future.

In summary, three conclusions can be drawn from this study. First, the enormous challenge posed by the pandemic crisis is a strong driving force that contributes to the expansion of the teachers' informal workplace learning. Their learning during the transition to ERT is largely social, practice-oriented and also embodied, and develops in collective processes and in interaction with material objects (cf. Boud and Rooney, 2018).

Second, with the support of digital technologies, vocational education and training can to some extent be carried out via remote teaching. However, teachers' professional knowledge and skills in terms of pedagogical digital competence (cf. From, 2017) seem to be a necessary prerequisite for the successful transfer of vocational teaching to remote teaching environments.

Third, the informal learning of the vocational teachers in ERT mainly involves learning outcomes that can be categorised as increased pedagogical knowledge and skills (cf. Hoekstra et al., 2009; Kang and Cheng, 2014; Kyndt et al., 2016). In teachers' learning about digital technology and pedagogical processes, expanded knowledge of the importance of learning environments for students' learning is especially important when it comes to trying to adapt the teaching to all students' need for learning support.

The analysis of the teachers' narratives shows that their informal workplace learning is strongly linked to the comprehensive problem-solving process they were involved in during the first three months of ERT. To what extent these solutions will have an influence on their future teaching cannot be predicted. However, it is quite clear that their professional knowledge and skills as regards teaching and their knowledge of students' learning have increased, which makes them better prepared for future changes in the field of vocational education.

Finally, this study has some limitations, with a small number of vocational teachers participating in the study and where the narrative material only covers the first three months of ERT, and so no general conclusions can be drawn. However, it contributes valuable practice-based knowledge in a research area that has only recently emerged as a result of the pandemic crisis. Based on the findings of this study, and the general lack of studies on ERT and remote teaching in VET, further studies focusing on teaching and learning and vocational teachers' formal and informal workplace learning are proposed.

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