

Teaching vocational pupils in their pyjamas: a socio-material perspective on challenges in the age of Covid-19

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Abstract

Purpose – Due to the global outbreak of Covid-19, Swedish teachers in upper secondary education were forced to conduct emergency remote teaching. As of today, there is a stream of research that addresses digitalization in education in light of the pandemic. Previous studies show that the challenges with the sudden intensification of digitalization have been particularly challenging in practical and aesthetic subjects. The research question is as follows: What challenges did vocational teachers experience during the emergency remote teaching caused by Covid-19 and what emergent tactics can be identified in vocational teaching practice?

Design/methodology/approach – The empirical data consists of (1) interviews with two vocational teachers and, (2) workshops with 25 teacher students from different vocational programmes that addressed vocational teaching during the Covid-19 crisis.

Findings – Emergency remote teaching meant challenges due to the changed socio-material environment that cannot easily be transformed to a vocational teaching setting. The challenges were related to authentic situations and material, problem solving and dexterity. Tactics that emerged as a response to the challenges were mainly connected to attempts to mimic vocational practices.

Originality/value – Contributions include explaining specific challenges and possibilities in developing vocational competence when teaching is digitalised. Furthermore, it increases the understanding of the relationship between theory and practice in vocational education. By adopting a socio-material perspective on vocational competence, the authors enhance the understanding of the importance of a shared socio-material environment.

Keywords Vocational teaching, Vocational competence, Digitalization, Covid-19, Socio-material perspective

Paper type Research paper



1. Introduction

The Covid-19 pandemic abruptly shifted vocational education from face-to-face teaching to teaching at a distance, and the normal way to live, work and learn changed drastically (Lee *et al.*, 2021). Implications are yet to be seen and the Covid-19 pandemic is also likely to change our ways of living, working and learning in the future. The shift to remote digital teaching has generated a growing interest in how non-face-to-face-education managed to replace face-to-face-education (Ferri *et al.*, 2020; Lo *et al.*, 2021; Poláková and Klímová, 2021). Shadaifat *et al.* (2020) illustrate attitudes towards vocational e-learning among vocational teachers, revealing challenges when using e-learning applications and suggesting training courses in using e-learning applications. However, research shows (Chan, 2021; Holmberg, 2021) that especially vocational education met challenges during the sudden move to digitally-enabled learning due to the nature of teaching and learning encompassed in this sector, often mentioned as “learning by doing” in learning environments heavily relying on machines, tools and materials. A report conducted by the Organization for Economic Co-operation and Development (OECD) illuminates the impact of the pandemic on vocational education and training, a part of the education system that has faced challenges. The report highlights how digital solutions could substitute for the theoretical parts of the vocational curricula. However, it reveals difficulties in reaching the practical-oriented parts in the curricula, which are also described as the main value and asset in vocational education. Other implications were the loss of instructional time and limited opportunities for work-based learning due to difficulties engaging apprenticeship places. OECD stresses the urgency of these questions when emphasising the importance of high-quality vocational education as a cornerstone of effective youth preparations for the labour market. Furthermore, the report claims that emerging advanced technologies, such as virtual reality, augmented reality and simulators can facilitate practical learning and be integrated into online-learning platforms to increase under-developed distance learning in vocational education (OECD, 2021).

In Sweden, the rapid transformation had implications for teachers teaching at a distance and changes included multifaceted changes in interaction (Holmberg, 2021; Willermark, 2021) as well as in the use of teaching methods and teaching material (Grönlund, 2020). Also, in Sweden, teachers in general needed additional knowledge about tools and strategies for teaching online (Grönlund, 2020) yet there are distinct differences regarding teachers’ perception of how teaching at a distance has worked (Willermark and Gellerstedt, 2022). However, most of the recent literature on emergency remote teaching due to the Covid-19 crisis is situated in the formal and compulsory school sector or higher education and there is limited literature on how vocational education and training programmes coped with this imposed change (Chan, 2021; Holmberg, 2021). Thus, little is known about the teaching situation for teachers in vocational education. In this study we explore emergency remote teaching in vocational education in Sweden. In contrast to many other countries, vocational education in Sweden is mainly organised as part of upper secondary education. There are 18 national programmes whereas 12 of those are vocational and six are programmes preparing for university studies (The Swedish National Agency for Education, 2021). In vocational education, pupils are educated and prepared for work as, for example, carpenters, electricians and assistant nurses, with the degree objective of developing their employability. The programmes are often described as close to practice because of their connection to working life, and practical knowledge is emphasised. The mission of the vocational teacher is thus to prepare their pupils for working life as well as for citizenship (Kontio and Lundmark, 2021; Rosvall *et al.*, 2020). We explore how teachers approach this task in light of the pandemic and address the following research question:

RQ1. What challenges did vocational teachers experience during the emergency remote teaching caused by Covid-19 and what emerging tactics can be identified in vocational teaching practice?

2. Theoretical perspectives

In this study, we use socio-materiality and vocational competence as analytical lenses to explore the challenges that vocational teachers experienced and the emerging tactics in remote vocational teaching practice caused by Covid-19. Socio-materiality offers a view of humans and technology as entangled and a process of mutual dependence. The relational ontology of the concept assumes that “the social and the material are inherently inseparable” (Orlikowski and Scott, 2008, p. 456). Materials such as objects and bodies, technologies and settings permit some actions and prevent others. They convey particular knowledge and become powerful and performative (Fenwick, 2015). Orlikowski states that: “There is no social that is not also material, and no material that is not also social” (Orlikowski, 2007, p. 3). Thus, humans and artefacts form a whole which cannot separate our thinking from the other parts of the environment in which we act. Professionals, such as nurses and electricians, rely on familiarity with a variety of tools, such as blood pressure monitors or blueprints that are directly dependent on their ability to perform their work. For vocational teachers, this means that they rely on a variety of technologies in teaching; these might be analogue, digital and general as well as profession specific. Using different artefacts includes a learning process that may involve observing and imitating the artefact in use, but often also needs instructions on how to act with the tool (Säljö, 2021). Different artefacts come with different requirements for prior knowledge to be used effectively and safely. Sometimes, the function is obvious through the design of the artefact, but in other cases, the artefact has properties that cannot be identified and used without extensive instructions and are thus black-boxed for the user (Latour, 1999). As pointed out by Säljö (2021) handling a shovel is intuitive, while the ability to handle a modern excavator requires instruction or tuition. Against this background, it is interesting to study the sudden transition to distance education in vocational education through a socio-material lens.

The connections between the expressed knowledge in the curriculum and the tacit (and often unexpressed) knowledge acquired in workplaces constitute the basis for vocational knowledge (Wheelahan, 2012; Young, 2004). The concept of vocational competence is complex and there are many definitions in the literature (Bathmaker, 2013; Billett, 2001; Fenwick, 2006). In this study, we rely on Hiim (2020), who presents a symmetric perception of the relation between theory and practice in which both are involved in building *knowledge* as well as *skills* and *attitudes*. *Knowledge* circulates around what can be verbalised through theory, and *skills* circulate around what can be practiced and performed motorically. *Attitudes* are related to working ethics. The concept of *vocational competence* could be seen as a combination of the three aspects (knowledge, skills and attitudes) which would all, from this symmetric view, contain both theoretical and practical knowledge. Billett (2001, 2006) emphasises the relations between the individuals’ actions and the social practice in which they act as crucial for developing vocational knowledge, conceptualised as *knowing in practice*. In this article, *vocational competence* is conceptualised as consisting of factual and theoretical knowledge on the one hand, and skills and attitudes on the other. *Vocational competence* is understood as being part of the symmetric perception of theory and practice (Hiim, 2020) and is, moreover, developed as *knowing in practice* (Billett, 2001).

3. Methodology

Empirical data was generated through, interviews with two in-service teachers at an electrical energy programme in a school named X (teachers are named teacher A, and teacher B in the result, referred to as TA and TB), and by observing discussions at a workshop with teacher students from different vocational programmes (named teacher student 1, 2, 3, etc. and referred to as TS1, TS2 etc.). The selection criteria were that all the informants should have experiences of teaching during the Covid-19 pandemic, either as teachers or as teacher-students.

The sample was selected to gain both a broad understanding of vocational emergency remote teaching by the works with workshop and gaining in-depth understanding by individual interviews with two teachers in one of the programs. For an overview of data see [Table 1](#). Informed consent was gathered from all informants and an ethical approval application was made, but was however, determined not to be necessary by the Swedish board for ethical approval (dnr: 2021-04827).

3.1 Analysis

Conducting an ethnographic study means that when reading documents, making field notes and transcribing interview material, promising analytical ideas often arise that can support the analysis further on ([Atkinson, 2001](#); [Hammersley and Atkinson, 1995](#)). In this study, the two interviews led to the idea of further investigating the teaching situation for other vocational teachers, in other schools and programs, during the pandemic through workshops because of the narratives that were illuminated during the two first interviews. The analysis was conducted in three steps ([Fejes and Thornberg, 2015](#)). During the first transcription work, interpretations of the first degree were conducted, which means stating what is being said. Concentration of the text was applied to find meaning. In the second degree of interpretation, a transcendence of the informants' descriptions into a systematic, theoretic understanding was conducted ([Fejes and Thornberg, 2015](#); [Hammersley and Atkinson, 1995](#)). In this study, overarching categories concerning the ways that the teachers acted as a response to challenges were related to remote teaching, but also to possibilities which emerged due to the new situation. The theoretical perspectives, socio-materiality and vocational competence, was not determined in advance but was based on an initial inductive

Data source	Number	Duration	Where?	Comments
Interviews Audio- recordings	Interviews with two teachers. Each teacher participated in two interviews	60 min per session (240 min in total) October 2021	Physical school building	<i>Interviews were conducted with two vocational teachers in the electrical energy programme. The semi structured interviews were recorded and manually transcribed verbatim. In this study, the interview was conducted as an interaction in which answers led to new unplanned questions</i>
Workshops Audio- recordings	25 vocational teacher students	180 min + 180 min November 2021	At campus	<i>The workshops were arranged as a part of vocational teacher education in a course containing learning goals about vocational competence and vocational teaching. The workshop took place in groups of four to six students, where they: (1) discussed questions about vocational competence and teaching, and (2) discussed the teaching and the prerequisites for development of vocational competence within the Covid-19 crisis and the remote teaching that followed</i>

Table 1.
Overview of data

analysis of the data when central and recurring themes were identified. Excerpts were divided into refined codes that reflected the teachers' experiences; for example: "lack of commitment" or "reduction in knowledge" linked to the transition to emergency remote teaching. To organise and analyse the data in the second degree of interpretation, NVivo was used. The interpretation was partly conducted within the research team and sub-types and variations of the main categories were identified, which reduces the risk of arbitrariness and subjectivity (Kvale *et al.*, 2014). The interpretation of the third degree presumes to question and search for underlying patterns that could be argued for (Fejes and Thornberg, 2015). The classification of the challenges and emerging tactics was then interpreted and discussed (Hammersley and Atkinson, 1995) both in the research team and as a member-check (Kvale, 2006) with the informants as they were invited to comment on the on-going analysis, which contributed to a deeper understanding.

4. Results

The teachers and teacher students described the remote teaching mainly as a challenge for developing vocational competence, but the experience also enhanced learning related to both pupils' needs and flexibility in differentiating teaching and digital competence. According to the teachers and the teacher students some pupils were said to thrive in a new way during the new situation. Furthermore, teaching could proceed because of digital technology such as learning platforms, online meetings, video-clips of instructions and activities, quizzes, and presentations online. Teacher colleagues became important resources in their learning as illustrated by the quote from a teacher student below.

TS6: We got important new knowledge about IT and the platforms as teachers. We learned many new functions that we did not know before.

However, this new socio-material situation caused challenges at several levels as elaborated below.

4.1 Challenges of a changed socio-material environment

One overarching challenge was described, by both the teachers and the teacher students, as loss of vocational competence-development connected to the lack of a shared material and social environment. The pupils did not practice their skills with their hands and senses, the oscillation between activities related to theory and practice did not occur, and there were difficulties in maintaining motivation as well as relationships. The situation did also highly decrease the pupils' opportunities to proceed in their practicum internship in workplaces connected to their education. The analysis revealed challenges in teaching concerning urgent and necessary learning. In school X, the teaching is normally arranged as if the pupils are at a workplace and entails a material environment with working booths, material, working clothes and working routines. Now the students did not even have to leave their bed or change into clothing suitable for work or school. The physical environment is, by the teachers and teacher students, seen as crucial in developing vocational competence. One part of the teaching routine, in school X, is that the pupils find their instructions and exercises on the learning platform. The exercises had to be remade from practical lessons with physical learning material such as cables, circuit breakers etc. into digital formats with digital learning material if possible. They also had to rearrange the order of the courses and choose to focus on the theoretical parts of them and wait for the practical exercises. The situation turned out to be unsatisfactory according to the teachers because of their pedagogical idea that assumes that learning is generated when activities are integrated through oscillation between theory and practice in a social environment like a workplace. The overall experience seems to be that

development of vocational competence was affected negatively by the emergency remote teaching.

4.1.1 To teach problem solving. When describing vocational competence, a common theme is that the pupils need to be able to solve problems in unforeseen situations. This ability is appropriated in numerous ways related to vocation. Among the teachers and teacher students in programmes related to industry, building and construction, vehicle and transport, and electrical energy a recurrent expression relates to the possibility of failure and reflection for pupils to become problem solvers. Failures are seen as invaluable experiences for the pupils and described as significant because of the emotions connected to failure. It is seen as a source of learning why and how machines and material are working but also to prevent expensive failure in their future workplace.

TA: I believe in making mistakes, that is really important for learning.

TB: The ones that fail in the exercises learn more than the others, because they must troubleshoot as well.

TS3: We are [consciously] building in failures, in the installations.

The strategy of deliberately tampering (by spraying water to simulate moisture in outdoor installations or building in a toy-mouse with copper wire, somewhere in the installation to create a short) involves teachers and teacher students utilising the learning material as a way to prepare pupils for developing problem-solving skills. This opportunity did not exist in remote teaching. Furthermore, the social aspect of learning how to become a craftsman is described as even more puzzling than learning the technical aspect.

For teacher students in the programmes related to care, education or service, failing was not the common way of describing how to learn problem solving. This learning is described as connected to human interaction and experiences when pupils get the opportunity to try their theoretical knowledge in action, for instance, in a method room or in cooperation with a workplace, followed by reflection. This was perceived as challenging in a digital environment.

TS5: We talked about that in our professions, because it is all about humans, we can talk about preschool or at a hospital ward, for example with dementia patients, it is a lot about the responsiveness, the feeling, and the ability to adapt to situations, but we need to add this to the theoretical knowledge. We talked about ethics and morals and the fingertip feeling, which is very, very hard to teach the pupils but our degree objectives rely on that a lot.

TS2: The situations that only occur. Build in failures, really good maybe, but for us in the programmes that work with humans, and you work actively with that, you wish to meet as many humans as possible during these years in education.

Thus, an interesting difference emerges between diverse types of vocational knowledge and how theoretical and practical knowledge is linked together and taught, and this also had consequences when teaching became digital.

4.1.2 A reduction of sense-using. The teachers and teacher students describe that the pupils were not allowed to practice with their hands and that this had major consequences for how they understood and remembered the information they received via the digital remote lessons. Vocational teaching usually oscillates constantly between the teacher describing something and illustrating this in some way, but also allows the student to look, listen to how to sound or how to examine, feel, smell and try.

TS8: It is difficult to find the variation in the teaching that you usually do. It becomes a lot more focused on written assignments. And that is not always the strength that the pupils have. And then maybe some students did well in writing but could not perform in practice when they came back to school.

TB: Well, when you do not have access to practice material how do you solve assignments then? They must practice these things they are supposed to work with later. It is not just possible to read or listen, they must use it. Do it.

The possibility of allowing pupils to use their hands and senses in remote teaching was perceived as a limitation and a challenge.

4.1.3 An entangled vocational competence. In the data, vocational competence is, by both teachers and teacher students, described as entangled, consisting of theoretical knowledge, practical skills and attitudes. The oscillation between theoretical and practical activities is described as crucial for learning vocational competence. During the remote teaching, all the physical material and the routines that usually support educational practice were pulled out from the teaching activity. The working clothes for the programmes that use those were in some cases exchanged for pyjamas and the tools and material normally used (such as simulators, working booths, care material and cables) were not available in the pupils' homes.

TS1: We talked about simulators before, that is nothing you have at home. It cost millions. To teach them to drive a vehicle, you actually have to be in the vehicle.

Neither did they practice interaction with each other or with real patients, children, material or customers which led to the experience of not developing vocational competence.

TA: It turned out we had to redo all the theory afterwards

S: Because it did not stick?

TA: Right, it does not stick if you take it out of context. They did not learn much. It's dexterity. I showed you an exercise before, that they would be able to perform in 24 hours, it is not like they would have managed it if they did not have it in their hands and then they need to practice that. Dexterity, autonomy, and material knowledge. The whole pedagogical idea of doing something practical and learning from that did not exist.

Furthermore, one practical problem related to this significant challenge was also the difficulty of arranging workplaces to accept new pupils for internships.

4.1.4 A difficulty of maintaining motivation among pupils. Teachers, as well as teacher students, perceive that it was difficult to stimulate the pupils' motivation and energy due to lack of social interaction and lack of practical exercises in a shared material environment. This challenge, which admittedly is not exclusive to vocational education, influenced the teachers' work and experience of digital teaching. The situation is described as uninspiring and monotonous, and the statements include descriptions of difficulties in creating an engaging learning environment.

TA: I believe the important thing was brain fatigue. You become a caveman eventually. And I think it would have worked out if we found some energy in the digital, if we could have done that then we could have done more of it. But we did not.

TB: They found it boring. And it was difficult with motivation and concentration.

Thus, both teachers, teacher students and according to them, the pupils, also found it challenging to maintain motivation and inspiration in remote digital teaching.

4.1.5 Establish and maintain relationships. Reasons for the limitations of vocational competence-development were also related to the digital environment. This was not found satisfying for the teachers, the teacher students, and pupils' need to establish and maintain social relations. The digital remote teaching meant difficulties in interacting with pupils and adjusting teaching to individual needs. The support that usually exists between pupils was also gone, even if the pupils sometimes created social groups online. The spontaneous conversations disappeared. Teachers and teacher students testify that remote teaching did

not enable building relationships among or with pupils. The difficulties specially occurred for pupils new to each other. It was also difficult to observe the pupils' reactions to instructions and assignments. However, in school X the teachers noticed that some of the pupils needed special attention. They state that those pupils usually benefit from social interaction with their classmates and learn through interacting with them.

TS2: The pupils could more easily hide what they did not understand. In the classroom you can easily see that, and that interaction is not happening at a distance. If you see that in the classroom you can approach the student and say, "Hey, why don't we take ten minutes later? Now it was just goodbye and a click."

TA: I think the learning was less than 10–20 per cent during this time. If they should leave us with the expected knowledge, if we would only teach at a distance, it would probably take nine years instead of three. It's both social, so much is happening within a workshop. It is high life all the time. They use their time well, they are social, helping each other, that did not exist at all. We are supposed to let out people that should be out and perform work at customers' places and talk to people. Social creatures, so to speak.

TB: If we speak to each other (on a screen), it is not the same as having the student in the same room. I think it is because we are in different environments. They are at home. There are a lot of things catching their attention. S: and when you are in the same room?

TB: Then we see the same things.

Pupils who have difficulties often develop strategies to hide that they cannot or have not understood information. Vocational teachers, who often work close to their students and spend a lot of time with them, can usually see this, but in distance learning this became more difficult to detect and also to work with.

4.2 *Emerging tactics and possibilities*

The emerging tactics refer to how the teachers approached the challenges they faced during the remote vocational teaching practice.

4.2.1 *Attempts to mimic vocational practices.* The usual way of teaching, oscillating between theory and practice, was disrupted but also compensated for. The informants tried to make the teaching and the content as realistic as possible. They used and created new teaching material (e.g. video-clips, podcasts, case descriptions and role-playings) and new situations for learning and interacting were arranged.

TS6: I constructed some new cases about patients, and they really had to write and describe, motivate why they did as they did. Out of laws, integrity, self-determination. But you could get some out of that even if it is not for real within healthcare.

In school X, the teachers realised the need for practicing the pupils' manual skills and dexterity (and also to prevent brain fatigue) and came up with compensatory solutions that were similar to their actual practical exercises. This had to be made possible without any material distributed from the teachers. The pupils used pictures and videos to describe what they did. This was something the teachers chose to use continuously when teaching went back to face-to-face teaching.

TA: We switched order so they studied all the theory first that they should have done later and now they do practice as they should have done last year. Now it is different because we do practical things all the time and then it was only sitting at the computer. And we had to produce our own material because the books were finished.

S: What did you do then?

TA: They had to practice their dexterity. It could be anything at home that they did. Someone joined their uncle who worked as an electrician, and some did some renovation at home. Some installed a network at home. Someone screwed together some furniture.

The teachers and teacher students also made changes in the groups and created new material and instructions. Lessons were, in some cases, shorter but more frequent; they allowed pupils to come into school and taught one group face-to-face and one group at a distance. This, however, was described as successful for the pupils that physically came to school but not activating for the pupils studying at a distance. This was also described as a considerably time-consuming setup for the teachers.

The data clearly show that in order to gain vocational competence, oscillation between theory and practice in a social and material environment is crucial. Thus, attempts to compensate for limitations in the digital environment were prioritised. Some theoretical content was described as suitable for remote teaching if practicing were possible in the near future.

4.2.2 Supporting pupils individually. Due to the challenges connected to relationship building and motivation, the teachers took actions to support their pupils individually. The need for distinct instructions became apparent as illustrated by the quote below.

TS6: Material must be really clear and available for the students in a new way. It must work; it has to be there. We as teachers have become more solution-focused and flexible in teaching.

There are also indications of attempts to create instructions and material to support the pupil's autonomy by using the learning platform and creating video-clips with instructions.

TB: Yes, I constructed power-points and video-clips that I explained that they could watch later at home. And I recorded some video-clips. For example, how they can construct drawings in a cad-programme. Then I made drawings and explained how I did so they could imitate at home.

In school X, the teachers also rearranged the time and support for the pupils in need, who usually also got help through the social environment. It became clear which pupils needed extra help and every day the teachers aimed to have contact with them. By observing scores in the digital teaching material and online meeting platform, the teachers became aware of who did not follow the plan.

TA: One thing I thought was good was that the pupils that needed more help than others we could follow up because the others were more autonomous and then you could spend more energy on the pupils that needed it maybe.

Thus, the new situation changed the needs. A finding, though, was that some of the pupils that used to be seen as pupils in need thrived during the remote teaching. This could have several reasons, such as the limitations of social impressions or that the teaching became distinct when the teachers had to give instructions in a new way. It could also have to do with the increased focus on written assignments. In relation to these expressions in the data, questions of validity in the assessment were raised.

5. Analysis and discussion

In this section we discuss the challenges and emerging tactics in the vocational teaching practice during the Covid-19 pandemic, through the lens of socio-materiality and vocational competence.

5.1 Challenges in emergency remote teaching

The main challenges in this study are related to difficulties in facilitating the entanglement of theory and practice in teaching in a digital remote socio-material environment when central material is removed. In this study, it is clear that the development of vocational competence, as a symmetric perception of knowledge, skills and attitudes (Hiim, 2020) is highly related to both the social and the material which is to be understood as inseparable (Fenwick, 2006;

Orlikowski and Scott, 2008) Thus, this study reflects the relational ontology of the social and the material as described by many as inherently inseparable (Fenwick, 2015; Orlikowski, 2007; Säljö, 2021). In a digital environment, the teaching could proceed but the dimension of teaching that requires oscillating between activities with theoretical and practical elements was lost, which contributed to an asymmetrical focus on what vocational competence consists of. The entanglement is seen as central in vocational competence, and teaching is often described as an oscillation between theory and practice in order to develop the symmetrical vocational competence consisting of knowledge, skills and attitudes (Hiim, 2020). Thus, this study underscores how futile the exercise of separating theory and practice is and how important the notion of this relationship is when it comes to vocational education.

5.1.1 Authentic situations and material. The authentic environment including socio-material artefacts such as tools and clothing as well as routines, is described as central in developing vocational competence. The data shows that a shared material and social environment is considered essential to achieve theoretical knowledge, practical skills and attitudes related to the targeted vocation (Hiim, 2020). Material as objects and bodies, technologies and settings permits some actions and prevents others (Fenwick, 2015). Changing the authentic teaching environment had implications in several important aspects. The clothes the pupils were wearing changed from working clothes or formal clothing or sometimes into pyjamas when participating in lessons from bed. This socio-material dimension of the professional role became difficult to discern and practice. Clearly, interacting with a customer or a patient from your private sphere, in your pyjamas, is not the proper way to behave. A part of being professional also seems to be connected to the routines that work consists of, and which are manifested in the material building. Normally, the pupils would drink coffee together, often have a meeting around a tool or material, discuss the tasks of the day and then take practical action. Even if the pupils had meetings online, they could not really relate to the practical work which would aim at increasing their familiarity with the material, or as Säljö (2021) suggests, imitating the artefact in use. Another crucial aspect of not having a shared material and social environment was that it affected the motivation for both pupils and teachers, as well as their opportunity to maintain a relationship with each other. Social aspects of vocational competence are highlighted in all the represented programmes and could be denominated as skills and attitudes (Hiim, 2020).

5.1.2 Vocational problem solving. The nature of vocational competence is multifaceted and there are differences related to the character of various vocations. In common, however, is the need to learn how to solve unforeseen problems. Problems are often wicked and the knowledge to address them is not “out there”, thus learners must be active contributors rather than passive consumers (Fischer *et al.*, 2020). Problem solving is, in this study, said to be learned by experiencing collaboration with others in a shared material environment, either by making mistakes and reflecting upon them or by experiencing interaction combined with reflection. One interesting difference in this study was the emphasis on making mistakes among the programmes directed to different types of production, and construction, in comparison to the emphasis on interaction among the programmes directed to care and service. Seen from a socio-material perspective, the relevant material for making mistakes, such as tools or bodies (Fenwick, 2015), were not available, which took the skills and attitudes away from the symmetry in vocational competence. Theoretical knowledge was asymmetrically emphasised, to the detriment of the practical knowledge development, but, when using Billet’s concept of knowing in practice (2001), vocational competence is not usually developed in this asymmetrical manner.

5.1.3 Dexterity and learning with all senses. Another common theme is the importance of learning with all senses and developing dexterity. To learn, the pupils need to experience with their senses so as to develop embodied skills that are a part of vocational competence (Hiim, 2020; Kontio and Lundmark, 2021). A socio-material perspective would highlight the need for

imitating the artefact in use (Säljö, 2021). In this study, these skills are expressed as tacit or “fingertip knowledge” and are taught via face-to-face experiences, either in a school environment or within an internship. What happened during the remote vocational teaching was that the pupils became more passive in regard to dexterity as a result of the changed socio-material environment. They did not even make valuable mistakes. The teachers and teacher students’ responses were to try to compensate by creating exercises or material supporting autonomy, dexterity, or social interaction but these could not mimic or compensate for the reality or the essence of their intended competence. To assemble furniture together could perhaps help to maintain skills in using a screwdriver; however, that was not the whole essence of the dexterity needed to be an electrician and containing a symmetrical relation between theoretical knowledge, skills and attitudes. Furthermore, Sandblad (2021) conceptualises the phenomenon *tacit engagement* and refers to what gets lost when we do not physically, with our bodies, find ourselves in a common physical environment. Sandblad points out that, social skills, such as empathy and insight into human character, get lost; these are both described as crucial in developing vocational competence in relation to skills and attitudes (Hiim, 2020). Medical cases, used as teaching methods, could perhaps theoretically explain how to give care to, and perform personal hygiene with, a patient, but the intended competence is more than that. It is about how to maintain the integrity of the patient, to look for symptoms, and feel the suitable temperature of the water used for personal hygiene. The focus in remote teaching was asymmetrically in favour of factual and theoretical knowledge, which vocational competence only partly consists of (Hiim, 2020) and, furthermore, is said to be learned in combination with practical exercises as knowing in practice (Billett, 2001).

5.2 Emerging tactics

In relation to the challenges (that had a significant overemphasis in the different discussions) with the backdrop of importance of the practical experiences in a shared material and social environment, it is difficult to imagine that any vocational education could be completely arranged remotely other than temporarily and due to some crisis. If vocational education should increase the use of remote teaching supported by digital innovations, as suggested by the OECD report (2021), the focus needs to be on how the entanglement of the factual/theoretical knowledge, skills, and attitudes benefits from experiences, including both theoretical and practical activities. The focus needs to be in the development of a symmetric perception of vocational competence (Hiim, 2020) with an understanding of the mutual dependence between humans and technology (Orlikowski and Scott, 2008). However, it is difficult to replace the embodied physical interactions prevalent in practice-based learning with its heavy reliance on guided practice (Chan, 2021; Säljö, 2021). Thus, the development of Billett’s knowing in practice (2001) is not realistically achieved without teachers and pupils having access to a shared social and material environment.

The emerging tactics can be seen in light of the pressure the teachers were under to make fast changes. The teachers and teacher students had to figure out solutions to unexpected problems as they learned how to use the new digital scene for teaching. The new situation stimulated collegial learning at some places, and new innovative ways to teach vocational competence and maintain motivation were explored. The remote teaching raised the question of how assignments and learning material can be reconstructed to create autonomous, social and problem-solving pupils, especially considering the attempt to mimic vocational practices, and the entangled theory and practice that vocational competence consists of. This, however, was not experienced as beneficial for learning.

But other processes also took place; for example, the insight into how some pupils benefited from this new setting and how time could be redistributed from the more autonomous pupils to the ones in need. On the contrary, the lack of social interaction with others in the meaning of knowing

in practice (Billett, 2001) might have created this need for those pupils. In some articulations, pupils in need were described as more easily hidden from interaction with the teacher, and in other articulations they were said to be instantly identified as pupils in need of continuous follow-up. The reason for these differences in the data is not possible to establish but could, of course, have many reasons such as size of the group, dependent on the vocational subject or the already-established relationships. Some of the pupils that used to be seen as pupils in need, however, thrived during the remote teaching, according to the teachers. Reasons such as the limitations of social impressions, increased number of written assignments or that the teaching became distinct when the teachers had to give instructions in a new way, were expressed in the data. This phenomenon could be further explored.

6. Conclusions

The challenges vocational teachers experienced during the vocational emergency remote teaching were significantly connected to changed socio-materiality. The oscillation between theory and practice is disrupted and the power of the vocational classroom as a learning space, including social interaction, the opportunity to learn from failure, working routines and learning material (such as tools and working clothes) is suddenly put out of play. The emerging tactics that can be identified in vocational teaching practice are connected to facilitating the entanglement of theory and practice supported by digital technology. This, however, turned out to be problematic when oscillation between theory and practice did not occur, which created an asymmetry in vocational competence in favour of theoretical knowledge. This asymmetry was not experienced as beneficial for pupils developing vocational competence. Contributions include explaining specific challenges and possibilities in developing vocational competence when teaching is digitalised and increasing the understanding of the relationship between theory and practice in vocational education.

References

- Atkinson, P. (2001), *Handbook of Ethnography*, Sage, London.
- Bathmaker, A.M. (2013), "Defining 'knowledge' in vocational education qualifications in England: an analysis of key stakeholders and their constructions of knowledge, purposes and content", *Journal of Vocational Education and Training*, Vol. 65 No. 1, pp. 87-107.
- Billett, S. (2001), "Knowing in practice: re-conceptualising vocational expertise", *Learning and Instruction*, Vol. 11 No. 6, pp. 431-452.
- Billett, S. (2006), "Constituting the workplace curriculum", *Journal of Curriculum Studies*, Vol. 38 No. 1, pp. 31-48.
- Chan, S. (2021), "Digitally enabling 'learning by doing'", *Vocational Education: Enhancing "Learning as Becoming" Processes*, Springer Singapore Pte.
- Fejes, A. and Thornberg, R. (2015), *Handbok i kvalitativ analys, [Handbook of qualitative analysis]*, Liber, Stockholm.
- Fenwick, T. (2006), "Learning as grounding and flying: knowledge, skill and transformation in changing work contexts", *Journal of Industrial Relations*, Vol. 48 No. 5, pp. 691-706.
- Fenwick, T. (2015), *Sociomateriality and Learning: A Critical Approach*, The Sage handbook of learning, London, pp. 83-93.
- Ferri, F., Grifoni, P. and Guzzo, T. (2020), "Online learning and emergency remote teaching: opportunities and challenges in emergency situations", *Societies*, Vol. 10 No. 4, p. 86.
- Fischer, G., Lundin, J. and Lindberg, J.O.J. (2020), "Rethinking and reinventing learning, education and collaboration in the digital age—from creating technologies to transforming cultures", *The International Journal of Information and Learning Technology*, United Kingdom.

- Grönlund, Å. (2020), "Skolans fjärrundervisning under Coronapandemin 2020: utmaningar, resultat och framtidsutsikter. [The schools distance teaching during the corona pandemic 2020: challenges, results and future prospects]", available at: <http://urn.kb.se/resolve?urn=urn:nbn:se:oru:diva-86545>.
- Hammersley, M. and Atkinson, P. (1995), *Ethnography: Principles in Practice*, Routledge, Milton Park.
- Hiim, H. (2020), "Å vurdere yrkeskompetanse: Hva er yrkeskompetanse, og hvordan kan den vurderes? [To assess professional competence: what is professional competence and how can it be assessed?]", *Nordic Journal of Vocational Education and Training (NJVET)*, Vol. 10 No. 3, pp. 45-66, doi: [10.3384/njvet.2242-458X.2010345](https://doi.org/10.3384/njvet.2242-458X.2010345).
- Holmgren, R. (2021), "Swedish vocational teachers' informal workplace learning during the initial phase of the COVID-19 crisis", *Education in the North*, Vol. 28 No. 3, pp. 121-139.
- Kontio, J. and Lundmark, S. (2021), *Yrkesdidaktiska dilemman. [Vocational Didactics Dilemmas]*, Natur & Kultur, Stockholm.
- Kvale, S. (2006), "Dominance through interviews and dialogues", *Qualitative Inquiry*, Vol. 12 No. 3, pp. 480-500.
- Kvale, S., Brinkmann, S. and Torhell, S.-E. (2014), *Den kvalitative forskningsintervjuen. [The Qualitative Research Interview]*, Studentlitteratur, Lund.
- Latour, B. (1999), *Pandora's Hope: Essays on the Reality of Science Studies*, Harvard University Press, Cambridge, MA.
- Lee, Y., Kim, W. and Woo, H. (2021), "A case study for technical and vocational education and training professional development training in Untact Era: focusing on official development assistance project in Botswana", *Journal of Technical Education and Training*, Vol. 13 No. 2, pp. 10-24.
- Lo, C.-C., Hsieh, M.-H., Lin, H.-H. and Hung, H.-H. (2021), "Influences of flipped teaching in electronics courses on students' learning effectiveness and strategies", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 18, p. 9748.
- OECD (2021), "Implications of the COVID-19 pandemic for vocational education and training", doi: [10.1787/55afea00-en](https://doi.org/10.1787/55afea00-en).
- Orlikowski, W.J. (2007), "Sociomaterial practices: exploring technology at work", *Organization Studies*, Vol. 28 No. 9, pp. 1435-1448, doi: [10.1177/0170840607081138](https://doi.org/10.1177/0170840607081138).
- Orlikowski, W.J. and Scott, S.V. (2008), "10 sociomateriality: challenging the separation of technology, work and organization", *Academy of Management Annals*, Vol. 2 No. 1, pp. 433-474, doi: [10.5465/19416520802211644](https://doi.org/10.5465/19416520802211644).
- Poláková, P. and Klímová, B. (2021), "The perception of Slovak students on distance online learning in the time of coronavirus—a preliminary study", *Education Sciences*, Vol. 11 No. 2, p. 81.
- Rosvall, P.-Å., Ledman, K., Nylund, M. and Rönnlund, M. (2020), *Yrkesämnen och skolans demokratiuppdrag [The Vocational Subjects and the School's Democracy Mission]*, Gleerups, Malmö.
- Säljö, R. (2021). "Från materialitet till sociomaterialitet: Lärande i en designad värld [From materiality to sociomateriality. Learning in a designed world]", *Techne Serien - Forskning I Slöjdpedagogik Och Slöjdetenskap*, Vol. 28 No. 4, pp. 193-208, doi: [10.7577/TechneA.4736](https://doi.org/10.7577/TechneA.4736).
- Sandblad, A. (2021), "Yrkeskunnande Maskiner Människor. [Professional knowledge, machines, humans]. (Publication number 47)", [Doctoral thesis, monograph, Högskolan Väst], DiVA, Trollhättan, available at: <http://urn.kb.se/resolve?urn=urn:nbn:se:hv:diva-17850>.
- Shdaifat, S.A.K., Shdaifat, N.A. and Khateeb, L.A. (2020), "The reality of using E-learning applications in vocational education courses during COVID 19 crisis from the vocational education teachers' perspective in Jordan", *International Education Studies*, Vol. 13 No. 10, pp. 105-112.
- The Swedish National Agency for Education (2021), *Gymnasieprogrammen*, Upper Secondary Education, available at: <https://bit.ly/3QhOfCh>.

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- Wheelahan, L. (2012), *Why Knowledge Matters in Curriculum: A Social Realist Argument*, pp. 1-194, doi: [10.4324/9780203860236](https://doi.org/10.4324/9780203860236).
- Willermark, S. (2021), "Who's there? Characterizing interaction in virtual classrooms", *Journal of Educational Computing Research*, Vol. 59 No. 6, pp. 1036-1055, available at: <http://ezproxy.server.hv.se/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=edo&AN=152078784&site=eds-live&scope=site>.
- Willermark, S.M.J. and Gellerstedt, M. (2022), "Facing radical digitalization: capturing teachers' transition to virtual classrooms through ideal type experiences", *Journal of Educational Computing Research*, January, 07356331211069424, doi: [10.1177/07356331211069424](https://doi.org/10.1177/07356331211069424).
- Young, M. (2004), "Conceptualizing vocational knowledge: some theoretical considerations", in *Workplace learning in context*, Routledge, pp. 201-216.

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