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Approaching Sociomaterial Complexity in the Vocational Teaching Practice with a Sense of Coherence

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Abstract

A complex, vocational school-based teaching practice with dual roles and contexts places demands on vocational teaching and the teaching materials involved. One of the challenges for vocational teachers is to teach with responsiveness to changes in working life. This study explores how vocational teachers enact and reflect on their sociomaterial teaching practice to enhance aspects of their student's sense of coherence (SOC). Data includes observations and interviews with three vocational teachers, representing three different vocational programs in Sweden. In the analysis three themes are highlighted: i) Materials, ii) Connections to working life, and iii) Human relations and interaction. Findings show how applying SOC is understood as a way to navigate a sociomaterial complexity, here and now, in the vocational teaching practice. The paper contributes to a discussion on how vocational teachers constitute teaching materials from a wide range of materials. Contributions include increased knowledge about teaching materials in the vocational teaching practice.

Keywords: vocational teaching practice, teaching materials, sociomaterial perspective, sense of coherence.

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Introduction

Vocational teachers have the complex task of teaching future citizens and a workforce in a rapidly changing society (Havreberg & Sylte, 2021; Rosvall et al., 2020). In Swedish upper secondary education, vocational teachers mainly teach in an educational setting that differs fundamentally from vocational realities, even if some educational institutions strive to imitate vocational practices (Gustavsson, 2013; Nyström & Ahn, 2020). The curriculum for upper secondary education in Sweden is divided into subjects and courses connected to learning goals. This also applies to vocational programs that educate electricians, assistant nurses, and chefs as well as other vocations. This is not the scenario in working life. Carlgren (2017) expresses the situation as fundamentally different in focus; in school, learning is in the foreground, whereas in working life, learning is a byproduct. Billett mentions this as different curricula (2006). When navigating the different curricula, one in working life, one in the educational context which also involves the students' varying needs, vocational teachers express frustration. However, the situation also cultivates creative ways of involving working life in their teaching (Carlsson & Willermark, 2023).

All teaching is complex, and complexity in relation to vocational teaching has been described in different ways in research. Vocational teachers have dual professional roles and teaching contexts (Kilbrink et al., 2023; Lahn & Berntsen, 2023). This makes vocational teachers' competence complex (Antera, 2023; Enochsson et al., 2020; Leonardsen, 2023). Thus, vocational teachers need to act with responsiveness to changes in working life and find it significant to foster their students in such a way that they can cope with the demands of working life (Andersson & Köpsén, 2019; Cattaneo et al., 2022). This also means navigating different contradictions in relation to students' needs, such as supportive and disruptive digital technologies (Carlsson & Willermark, 2023). Moreover, content in vocational teaching contains practical and theoretical aspects, including objects such as tools and machines relevant to the profession (Andersson & Köpsén, 2019; Asplund et al., 2022; Köpsén, 2019). Thus, vocational teaching is heavily reliant on teaching materials. There has been a recent decision in the Swedish parliament that teaching materials will be defined in the Education Act (SFS 2010:800) as textbooks, learning materials, and learning tools. Furthermore, the school inspection will scrutinize students' access to textbooks and other learning materials. In the Higher Education Ordinance, a new degree objective for teacher education, which ensures teachers' abilities to use and evaluate textbooks, learning materials, and learning tools, will be implemented from 2024 (SFS 1993:100). In this study, the term *teaching materials* is used as an even wider concept since all materials that vocational teachers use cannot be accommodated within the current definition of textbooks, learning materials, or learning tools. Here, teaching materials include analogue materials as well as digital general pedagogic, mundane, or vocational-specific materials. Contemporary education political discussions are affecting vocational teachers; however, their teaching practice is not necessarily visible in it. In this teaching practice, they strive to deal with complexity that comes with teaching for a changing working life, in an educational context. Researchers call for contributions in exemplifying, documenting, and theorizing vocational teaching practice (Herrera & Gessler, 2018; Lahn & Berntsen, 2023; Tyson, 2019): a vocational didactic that can cope with the complexity of learning that takes place in a classroom, in the workshop, or in working life needs to be developed (Herrera & Gessler, 2018).

One way to explore complexity in activities is to use the perspective of *sense of coherence* (Antonovsky, 1993, 1996), which entails the aspects of meaningfulness, manageability, and comprehensibility. This is how the complexity of vocational teaching practice is captured and analyzed in this study. Furthermore, any attempt to reconceptualize learning from a transformational perspective in the 21st century needs to engage in assumptions about socio-technical relationships and consider which practices and discourses they lead to (Cerratto Pargman, 2023). Sociomateriality in vocational teaching has shown to be crucial for teachers when oscillating between theoretical and practical elements to enhance vocational competence (Kilbrink et al., 2021). Thus, a sociomaterial perspective that focuses on the interaction between human and material, together with sense of coherence, a constructive didactic approach, were chosen as analytical perspectives. This study shed light on three in-service vocational teachers' reflections on how different teaching materials and activities can enhance aspects of vocational students' sense of coherence. The research question is as follows: *How do vocational teachers enact and reflect on their sociomaterial teaching to enhance aspects of their students' sense of coherence?*

Related Research

The field of vocational didactics is under-researched and under-theorized (Lucas, 2014), especially concerning teachers' reflections on teaching materials (Asplund & Kontio, 2020; Kontio & Lundmark, 2021). Furthermore, vocational teaching is complex. Frelin (2013) mentions different complexities in teaching in general. *Content, purpose*, *meaning,* and *method* are four aspects of complexities that all teachers need to consider. Thus, the related work is presented with those complexities in mind. The related work is in a Scandinavian school-based teaching context. The reason is that in Sweden, vocational education is mainly organized as a part of upper secondary education, in contrast to many other countries.

Firstly, the content, or "*what*"*?* in vocational teaching has dual origins which are manifested through the dual professional role of the vocational teacher (Lahn & Berntsen, 2023). Besides the educational context, it originates from working life and the knowledge the vocational teacher holds from working experiences (Andersson, 2019; Köpsén, 2014). Research emphasizes that vocational didactics need to meet special requirements, such as temporality and the changing nature of work (Gessler & Herrera, 2015). The curriculum gives direction to what content and knowledge the teaching should cover; however, it is up to the teacher to interpret the curriculum. The learning content is often considered as concrete and specific, involves physical work and interactions between learners and materials (Kilbrink et al., 2023), and knowledge about how to handle tools and machines is central in the curriculum (Andersson, 2019; Asplund et al., 2022; Lindberg, 2019). This means that the materials, besides being tools for learning, are partly the content. There is a need but also a difficulty for vocational education to be equipped with relevant technology and teaching materials to enhance the empoyability for students (Nyström & Ahn, 2020). Research in the vocational didactic field has explored a variety of teaching materials, such as driving simulators (Gustavsson et al., 2020; Nyström & Ahn, 2020), tools and machines in educational workshops (Asplund et al., 2022), digital tools as boundary objects (Enochsson et al.,2019; 2020; 2022), and smartphones in the Swedish vocational classroom (Asplund & Kontio, 2020; Kontio & Asplund, 2019).

Secondly, the purpose, or the answer to the question "*why?",* of teaching is complex. Teachers in general must use their judgment to combine different purposes in governing documents, practices for assessment, and content in teaching materials (Frelin, 2013). The purpose of vocational teaching has a clear anchoring in a practice outside of the educational institution (Gustavsson, 2013). This also implies that the purpose of the teaching is influenced by both practices (Andersson, 2019, Gustavsson, 2013). Vocational students are expected to develop a professional identity that holds both expectations of fitting into the vocational practice as well as developing practical and theoretical knowledge adequate to the vocation (Andersson, 2019). But what does it mean to be competent within a vocation? Vocational teachers mention different aspects, such as developing skills to solve problems, being able to adapt to new situations, being able to handle the materials and tools for vocational practice. Gåfvels (2016) mentions aspects related to the florist training, such as economics and aesthetics, language, materials, as well as tools and doings. Other skills mentioned as important to develop are interest, understanding of the integration of theory and practice, as well as socially appropriate behavior for the profession. This also contains the ability to continue to learn (Kilbrink et al., 2014). Lindberg (2003) describes *vocational knowing* as a combination of making situated assessments, developing a vocationally relevant language, and being familiar with tools, materials, and techniques as well as planning and practicing an ethical approach. In sum, whether we use the concept of vocational competence, knowledge or knowing, it can be described in various ways but is often seen as situated knowledge (Billett, 2001; Gåfvels & Paul, 2019). Moreover, the use of material is seen as central to all the concepts. In this study, the sociomaterial aspect of teaching in a vocational classroom is in focus even though vocational competence can be understood in different ways.

Thirdly, *meaning* creates unpredictability. According to Frelin (2013), students learn when interacting with their surrounding environment, which means that the students might learn, or are limited from learning. Research has highlighted that students learn just by being in an educational context but it is not always the case that they learn according to the teachers' intentions (Frelin, 2013; Osberg & Biesta, 2007). Thus, a teaching situation is impossible to predict in advance. Asplund et al. (2021) discusses the complexity of vocational learning when objects of learning can be experienced in a nuanced way by students and suggests that vocational teachers navigate between helping students with problem-solving here and now and at the same time contextualize the specific vocational learning content for future working life.

Finally, *methods* in vocational teaching are the answer to the didactical question "*how?".* Vocational didactics have special features because of their origin in working life but also because of where they take place and the teaching materials involved (Andersson, 2019). Kilbrink et al. (2021) point out that vocational teachers use several semiotic resources at hand, such as speech, embodied resources, and a wide range of vocational-specific and general pedagogic objects. Methods in vocational teaching often contain practical and theoretical aspects, including tools and machines relevant to the profession. In a literature review, Wyszynska Johansson & Andersson (2024) conclude that school-based vocational didactics offer opportunities for occupational practice, but also rely on the teachers' choice of method. Methods mentioned are telling stories, roleplaying, step-by-step modeling, or using specific technologies such as driving simulators. One important aspect of the "*how?"* in vocational didactics is pointed out by Holmgren (2024, p. 100), stating that vocational teachers "take an interactive learning-

environment-related approach, which means that, based on their understanding of the students' difficulties, they develop adaptations to stimulate their students learning and development", as a prioritization when students' needs in vocational education and training have increased over time.

Overall, previous research shows that content and purpose in vocational teaching have dual origin and are closely connected to teaching materials that also constitute the content. Both students and teachers have different experiences, which affect the meaning of the teaching and make the teaching situation unpredictable. Methods in vocational teaching are closely connected to material aspects when oscillating between practical and theoretical elements in teaching. However, how vocational teachers reflect on their sociomaterial teaching to enhance aspects of their students' sense of coherence seems to constitute a gap in research.

Theory

In this study, *sociomateriality (Fenwick, 2015; Orlikowski, 2007) and* the framework s*ense of coherence* (Antonovsky, 1996) are applied to support the analysis. Sociomateriality constitutes the ontological understanding of humans and materials as entangled and mutually dependent, whereas sense of coherence sheds light on the aspect's *meaningfulness*, *manageability,* and *comprehensibility* in teaching activities; in this case, vocational teachers' reflections on their teaching.

Sociomateriality offers a view of humans and technology as entangled and mutually dependent and tends to examine the whole system. Human consciousness and intentions are not privileged but are, however, recognized as a part of the activities in focus (Fenwick et al., 2012). Materiality and interaction with the materials are foundational for learning and materiality has shown to have a crucial role in shaping everyday schooling practices (Fenwick, 2015; Säljö, 2021; Valasmo et al., 2023). A relational point of view of learning focuses on how educational technologies participate in teaching activities (Cerratto Pargman, 2023). Materials, such as objects and bodies, technologies, and settings permit some actions and prevent others. They convey knowledge and become performative (Fenwick, 2015). Exploring teaching from a sociomaterial perspective does not only encounter how teachers and students act in or affect activities, but also how nonhumans, such as teaching materials, play a role in those (Valasmo et al., 2023). In this study, the interaction and mutual dependency between the social and the material is explored from a sense of coherence perspective in relation to the observed teaching focused on teaching materials, and teachers' reflections about them in the vocational teaching practice. Of course, the materials cannot experience a sense of coherence but it can be interpreted to manifest the different aspects of sense of coherence.

Sense of coherence (SOC) (Antonovsky, 1996), sheds light on the aspect's *meaningfulness*, *manageability,* and *comprehensibility* in teaching activities and vocational teachers' reflections on their teaching. The perspective, initially a contribution to research within health promotion, advocates a salutogenic orientation combining the cognitive, behavioral, and motivational aspects of coping with health issues. However, it is also used within educational literature (Bracha & Hoffenbartal, 2015; Hansen, 2017; Hanssen, 2023; Hatlevik & Hovdenak, 2020; Levi et al., 2013). Here, *meaningfulness* refers to motivational aspects of learning, *manageability*

refers to experiencing sufficient resources, and *comprehensibility* refers to capacity in relation to understanding (Hanssen, 2023). These aspects are interdependent for each other (Edfelt et al., 2019) and strong SOC can prevent stress and dropouts in vocational education (Hansen, 2013). Hansen (2023) concludes in a study from Norway that the comprehensibility for vocational students increases when theory and practice are integrated in activities during the apprenticeship. Manageability is understood as crucial to deal with stress and unpredicted tasks. However, meaningfulness is understood as the most critical component to enhance comprehensibility and manageability, thus needs to be highlighted in educational institutions. In terms of sociomateriality, the SOC framework can provide insights into how individuals perceive and interact with the material world around them.

Methods

Methods for data generation, inspired by an ethnographic approach, are observations of vocational teaching, and interviews with the observed vocational teachers, who were given pseudonymized names. The focus is on teaching activities and teaching materials in three different vocational programs: the Electrical Engineering program (Peter), the Health and Social Care program (Rebecka) and the Food and Restaurant program (Anna). The participating teachers were selected based on their participation in a previous study conducted by the author. The participating teachers all had in common that they discussed how they were navigating the tensions between expectations from working life and the needs of their students. The observations took place in different time spans. Peter was observed (99h) between 2021-2023 and observations were expanded with Rebecka (45h) and Anna (51h) in the timespan of 2023-2024. The role of the researcher was that of a minimally-participating observer. This role is described as the observer being open with observing, but not, however, participating more the necessary (Bryman, 2016). The data corpus (Braun & Clarke, 2006) i.e., all the data collected for the study, consists of a range of data sets informed by the research question of this study. One data set was generated using an observation template to systematically conduct the observations of teaching as well as inform the interviews with the teachers. The observation template was documented with fieldnotes divided into four parts: a short pre-conversation, a table for observing the lesson, a post-conversation, and a reflection part. The table focuses on materials, teachers' sayings and actions, and students' sayings and actions. Another data set consisted of audio recordings used in interview situations with the teachers, with a minimum of two x 45 minutes for each teacher. Finally, field notes (Bryman, 2016) and photos were additional data sets produced during and in between the observation sessions.

Table 1: The empirical material.

Informant	Observations	Supplementary Interviews	Comment on time
Peter, a trained teacher, 35 years old, vocational teacher at the Electrical Engineering program with five years of teaching experience.	Field notes from 10 observations with before and after reflection sessions	Two transcripts from interviews, in total 130 minutes.	99 h in total.
Rebecka, a trained teacher, 50 years old, vocational teacher at the Health and Social care program with 12 Years of teaching experience.	Field notes from 20 observations with before and after reflection sessions	Three transcripts from interviews, in total 95 minutes.	45 h in total. Due to Rebecka having short lessons, the number of data is higher, however not representing time spent observing in the classroom.
Anna, a trained teacher, 31 years old, vocational teacher at the Food and Restaurant program with 10 years of teaching experience.	Field notes from 10 observations with before and after reflection sessions	Two transcripts interviews, in total 80 minutes.	51 h in total.

Ethical considerations

Informed consent was gathered from teachers and students. In relation to the interviews and observations, teachers and students were provided with both verbal and written information about the study, the possibility to withdraw their participation at any time, and that their personal information would be handled with respect for their integrity. An application for ethical approval was made to the Swedish Board for Ethical Approval (dnr: 2021-04827), but was not, however, assessed as needing ethical approval.

Method of Analysis

In a classroom, a wide range of actors, both human and non-human, are brought together and constitute manifestations of the teaching practice. This is a multiplicity, difficult to grasp in observations and interviews. However, the analysis must start somewhere (Valasmo et al., 2023). Drawing on sociomateriality, materials, procedures, or actions in the data were identified in the observations and were reflected on together with the informant as a part of data production. This approach supported identifying and tracing understanding in the teaching situations (Roth, 1996; Valasmo et al., 2023); in this case, the sociomaterial manifestations of sense of coherence in the vocational teaching practice. Manifestations in this study are understood as the actions, interactions, and expressions made by the teacher in the classroom and in the conversations before and after lessons. Reflexive thematic analysis (Braun & Clarke, 2022) was used to identify, analyze, and report themes within the data corpus. This suggests that a researcher's subjectivity is a part of the organic coding process. There is a deep reflection and engagement with the data while generating themes (Braun & Clarke, 2019). This was also supported by the fieldwork when making field notes, and transcribing interview material, when promising analytical ideas arose.

"Themes are creative and interpretative stories about the data produced at the intersection of the researchers' theoretical assumptions, their analytical resources and skill, and the data themselves" (Braun & Clarke, 2019, p. 594). A theme is also recognized as capturing something important in the data in relation to the research question. Thus, themes identified in the analyzing process were related to a theoretical approach with the research question and the theoretical lenses in mind. In the analysis, an ambition was to progress from the level of semantic content to the meaning beyond what the participant has said and done in an interpretative level (Braun and Clarke, 2006). The connection to the aspects in SOC is not clearcut in the analysis and the aspects are interdependent. Furthermore, it is not within my knowledge whether the teachers were considering a certain aspect in SOC when reflecting on their teaching. Nevertheless, in the analysis SOC became an interpretative story when combining the data with my own theoretical assumptions as it was capturing most of the data over time. An example to illustrate this was when the informants reflected on *technology trouble* as creating obstacles for students' comprehensibility. Another example was when teachers reflected on how their own passion for work was manifested by using social media. The analysis was carried out by firstly, familiarizing with the data, partly together with another researcher. Secondly, general initial coding gave 17 codes such as *technology trouble, vocation-specific materials is highlighted,* and *importance of teacher knowledge and experiences*. Moving on meant searching for themes, then reviewing, and naming them (see Figure 1). The three themes are i) *Materials*, *ii) Connection to working life* and iii) *Human relations and interactions*. The analysis was also partly reviewed together with the observed teachers as a member-check, to refine and gain a deeper understanding of the themes.

Result and analysis

This study sheds light on how in-service vocational teachers enact and reflect on their sociomaterial teaching to enhance aspects of vocational students' SOC. In the analysis, the overarching theme, *Vocational teachers' reflections on sociomaterial manifestations, when teaching their students, here and now, from a sense of coherence perspective,* consisted of three underarching themes within the total of 17 initial codes (see Figure 1). In the following section, the three themes are presented with the help of examples displaying the codes, in some cases, combined and merged together.

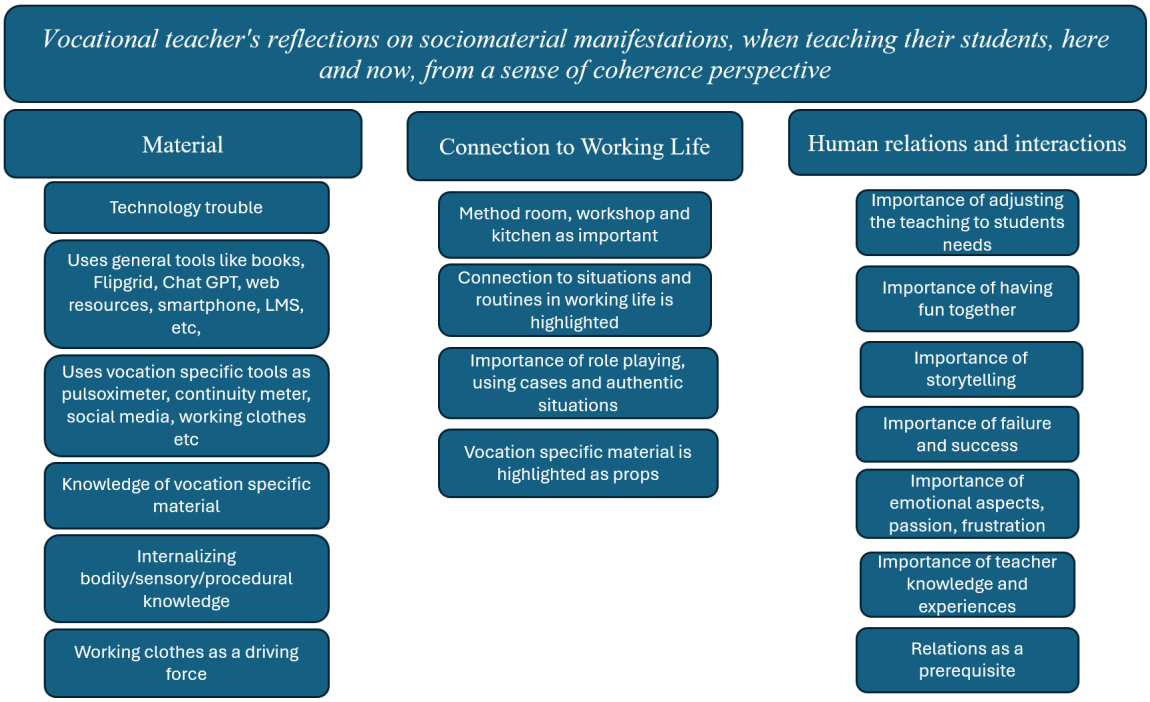

Figure 1, *The overarching theme, subthemes, and codes.*

Materials

The first theme emphasizes a wide range of teaching materials as crucial to support the embodied knowledge and routines that vocational teachers find useful for their students. Embodied knowledge and routines are here understood as sociomaterial resources from working life integrated into teaching. All three teachers use general pedagogical and mundane tools as well as vocation-specific tools. Here, working clothes are a centrality. The theme also reveals that vocational teachers are surrounded by technology trouble.

General pedagogic and mundane tools

As in most teaching, a wide range of pedagogical and mundane tools are involved. Books, web resources, power points, smartphones, and learning management systems are examples. Some of the data has to do with students learning the vocation-specific language. This is done in many ways, including using textbooks, storytelling by the teachers, or seminars among the students. At one point, Peter was listening to the textbook with some of the students while some students preferred to read for themselves. Combining reading, listening, and speaking makes the content comprehensible, according to the teachers. Smartphones are, in some cases, collected but sometimes used to solve problems, thus a proper way of using the smartphone is emphasized in the data. If the network is down, the students can use their smartphones. If Peter quickly wants to display something for a student, he picks up his own phone, or asks the student to google the manual for the device they are working on. He also launches 15 minutes of reading after every day in the workshop. This is preferably done on the smartphone and has to relate to the

electrical industry. He has the idea that this will help the students to plan their time well, and also become better readers in their knowledge field, which was illustrated by "a literate electrician is unbeatable". Moreover, he imagined he could "hack their algorithm", expressing that when the students scroll at home later the same day, their content will be increasingly about content relevant for an electrician. The smartphone is also used by Anna. She communicates with the students via Google Chat about changes in the schedule, their ideas for the menu, or questions they might have. Previously, she had communication on several channels but for manageability she is really satisfied with Google Chat and especially the feature of tagging people. She also frequently takes photos in the kitchen and posts them on social media channels.

Generative AI such as Chat GPT is another technology used for increasing teacher manageability when having little time and needing ideas for how to plan the lesson or to create a case or a quiz for the students. However, none of the informants expressed that they yet use AI with the students. For Rebecka, that has to do with not trusting the quality of the help it provides. For Anna, it has to do with taking responsibility for the learning environment in the group and not feeling secure about how to manage the situation: "I'm not sure yet so I would like to be that before I try. I don't want to lose the students if I'm not able to help them." For Peter, the practical use with the students is not obvious as a resource. Instead, several times in the data, analogue material is favored with the motivation that students need knowledge about physical material that is embodied, and they need to think for themselves and not take shortcuts. The knowledge that the teachers are aiming for needs to be internalized and possible to act on in many uncertain situations. This is illustrated by Peter saying to his students "that they need to always think about procedures such as being good at clamping the cable, working during time pressure, knowing their materials, and thinking about ergonomics".

Vocation specific tools

Besides general pedagogic and mundane tools, there are many examples of using vocation-specific tools in teaching. All three teachers often use roleplaying or storytelling. Here, they themselves constitute vocational material together with the props they have at hand. For instance, when Rebecka is roleplaying with her students, it involves materials such as a blood pressure monitor, a pulse oximeter, a clinical thermometer, test tubes, gloves, and working clothes. In the roleplay, Rebecka is playing the nurse. When Peter is roleplaying with his students, a wide range of materials such as continuity meter, toolbox, cables, and drawings is involved. Peter mostly takes the role of a customer or a project manager. Here, working clothes are a centrality in the data. The question is often raised by the students as to whether they need to change clothes for the lesson. Rebecka said that "working clothes are important for the student's engagement and ability to switch roles from being a student to being a professional assistant nurse". Anna even finds it difficult to engage the students in the classroom without their chef´s coat or the concrete kitchen environment. She said, "Clothes are so important, you get so much in the bargain when you put on the chef's coat. It's another dynamic in the group. You become somebody else. The teacher becomes somebody else. In the kitchen they want to be close to me, in the classroom they want to be as far away as possible." This is why Anna often tries to connect the activities in the kitchen to the activities in the classroom by telling stories from working life.

Technology trouble

There are also examples of technology trouble in this theme. Teaching is happening here and now and that makes teachers dependent on the materials at hand. Once, the basement was flooded, causing outdoor lessons for Peter. More than once, the network was not working sufficiently for Rebecka. For Anna, the situation in the group demanded close monitoring by her and she expressed that "students are easier to reach when digital technology is out of the situation". There are also expressions about lacking relevant digital technology and the mismatch between the available technologies and the wanted ones. To increase authenticity, Peter has repeatedly described ideas for how to integrate vocation-specific digital technologies with varying success. A business system for electricians in which customers can be managed, an electrical vehicle charger or a cable finder are all technologies that one could use as an electrician. According to Peter, they are meaningful to work with in education but not, however, always possible to integrate into teaching. A related issue seems to be not having sufficient time or resources to learn about technology that the teachers find important to increase manageability for the students. Also, either the network was not compatible with the desired technologies, or the free software was suddenly not working.

Another idea Peter had was to introduce a digital queuing system in the workshop for increased quality when helping the students and for them to plan their time well. Peter said: "If you are waiting for help and you are stuck, and you don't know if it takes one minute or 40 minutes before you get help, this leads you as a human to believe it will take like five minutes and then you don't need to start doing something else. Then it just means that you will poke around." However, he had only started when the system suddenly stopped working and he had to go back to the previous way of working. His experience was that it could have benefited the student's manageability but had not found any new free software with the same features. Smartphones are also connected to trouble, experienced as disturbing, and often collected at the beginning of class, especially by Anna in the kitchen and in the classroom. Sometimes Rebecka reflects on how she should have collected them due to them being disturbing but forgot to. When it comes to the students' engagement, Anna expressed that she often prefers analogue material, such as the individual white board, pen and paper, as illustrated by her comment: "It is hard to know if they listen to me or if they are playing games". In the cases of Rebecka and Anna, a change of learning management system (LMS) was also experienced during the observations which caused difficulties for their students. "Where did all the comments go" (Anna) or "Where can files and lesson plans be found?" (Rebecka), were questions asked initially. Also, the students not using the LMS was one thing Rebecka found that decreases manageability.

Connection to working life

The second theme reveals the importance of the connection to working life. This is manifested in various ways through materials. The traditional classroom, the extended classroom, and experiences from working life are represented in the data when roleplaying and incorporating routines.

The extended classroom

The vocational classroom is sometimes a traditional classroom and sometimes teaching takes place in an extended classroom, such as a method room, a workshop, or a kitchen. Those are rooms in the school-based vocational teaching built to imitate a workplace environment in terms of materials. Expressions in the data occasionally differentiate between more practical and theoretical activities. Peter described the practical activities, often taking place in the workshop, as more graspable and therefore easier to make comprehensible. However, the activities need to be informed by theoretical or factual knowledge. Similarly, Anna said that the activity in the kitchen is easier to make comprehensible and that she struggles with making content in the traditional classroom comprehensible as well. Rebecka reflected upon the practical activities in the method room and her idea is that this particular group needs to be informed by theory or facts first, otherwise the roleplay in the method room is not going to enhance the students' learning. At the same time, reflecting on lessons in the method room, both Rebecka and I had observed a higher student engagement than in the traditional classroom.

Roleplaying and cases

Roleplays, staged by the vocational teachers, takes place in a method room, or in a workshop where a variety of materials constitute props. Digital technologies such as Flipgrid, generative AI, and social media are experienced as a support. Rebecka said that she needs to develop the students' communicative skills when it comes to reporting for patients' safety. In the roleplay where she is the nurse and the students are the nurse assistants or patients, they need to take notes from her reporting a case, illustrated by: "You will not make it in the profession if you can't take notes. Then it can be about life and death". After that, tests according to NEWS2 (National Early Warning Score 2) and reporting according to a communication model called SBAR (Situation, background, assessment, recommendation) is the task. For support, Rebecka has created plastic cards with information on NEWS2 and SBAR. Normally assistant nurses would report orally or in a digital journal system. Thus, Rebecka has found a free software called Flipgrid that she enjoys using. In the software, the students create small video clips where they report to her and the class, and they can give feedback on the reports. Initially, her idea was only to use Flipgrid for reports for the work with patients; however, she expanded its use to also include patients reporting the experience of being patients, and on other work that students do in the classroom.

Situations and routines from working life

One cannot say that Anna is roleplaying to the same extent, because she is running a kitchen, with real paying guests together with the students. Materials such as groceries, pots, knives, and recipes are complemented with the important *mise on place*, a routine that Anna learned when working in the restaurant industry and that she finds particularly meaningful for students learning how to work and collaborate in the kitchen. She described it as "a kind of to do list, a tool template of what to use". In the classroom, when working with nutrition, she reminds the students of the routines they have in the kitchen and how they need to think similarly when working on their school tasks. This authentic situation aims at creating a meaningfulness for

the students and the engagement in the kitchen is easy to observe. The students practice the vocabulary of a kitchen staff, and you can suddenly hear "behind", a signal that somebody must move quickly. After the cleaning, there is time for reflection together with discussions of how the cooking and serving went, and communication is one of the topics of scrutiny. Peter also expressed the vocational routines as crucial for students' manageability. The routines that are similar to working life help him and the students to organize the lessons in manageable sequences. The materials supporting the routines are, for example, the whiteboard displaying the current roles in the group, written forms for the roles on how to follow protocol, and electrical materials needed for installations. The students inspect each other's work, and there is a security procedure for testing the installations.

Human relations and interactions

The third theme revolves around the necessity of human relations and interactions connected to materials. Relations and emotional aspects are seen as prerequisites, as is teachers' adjustments to students' needs. The theme also reveals the teacher as teaching material manifested by sharing their passion and experiences from working life, often by storytelling.

Relation and emotional aspects

All three teachers expressed relational and emotional aspects as joy, passion, and frustration related to failure and success as really important. Anna highlighted the importance of knowing her students well enough to know what they are engaged by in the classroom. Similarly, Peter reflected on enhancing meaningfulness by knowing why the students are there. He thinks that most of them are there because they would like to have a job and to pay their bills. Therefore, he repeatedly refers to people he and the students know and tells stories about how they make money by being good at their work. He can also give credit to a student by saying, "That was good-looking bending, this we could invoice". In one sequence, Peter was displaying a difficult installation from an Instagram profile which led to some of the students really wanting to try to imitate what they spoke of as the best installation they had ever seen. Some of them became frustrated and Peter reflected on the students' need to do something else at the moment, because they felt overwhelmed. However, at the same time, he found that a good thing because frustration will eventually increase motivation if the situation is manageable for the students. Also, Anna expressed her passion for the restaurant industry several times and is sometimes disappointed if the students do not share her passion. Thus, she is acting to awaken the student's passion for food. One way of doing that is to use social media such as TikTok and Instagram accounts that she and the students are inspired by. Another way is to successively let the students plan their own menus. The students then communicate with her via Google Chat about their ideas for next week's menu so she can prepare the kitchen. Weekly, she posts the process in the kitchen, together with the final arrangement on the plates in social media accounts connected to the teaching.

Adjusting teaching to students needs

The importance of adjusting the teaching materials to the students' needs is one common reflection among Peter, Anna, and Rebecka. The students need different kinds of instruction as well as different kinds of opportunities to express themselves. The teachers all reflected on how they need to be careful of overloading the students with content, for example in the LMS. Here, the teacher's ability to choose and condense relevant content is highlighted. Rebecka said: "If one student has issues learning something from my lecture or from the book, I find a videoclip that is optional to use". In the *mise on place* routine, Anna let the students prepare for another student coming the next day with the preparations of recipes and tools in a tray. In that way, they can decrease stress and increase a sense of autonomy, self-confidence, and manageability in the kitchen. *Anna said: "*If you can build self-confidence the rest comes with it. But if you do not have self-confidence and don't feel that things are going well, it is difficult to learn." Finding the right level is expressed as important and has to do with knowledge that needs to be internalized by the students. The teachers expressed in different ways that in working life there is no time to learn the basic vocabulary or procedures even if the learning continues. Rebecka said that the engagement is sometimes low in the group and that this has to do with the content being too difficult for the students. When the students know some of the content and they can use it in the method room or discuss it in a seminar, the engagement increases. She therefore uses repetition. This is done by, for example, taking the same quiz using pen and paper more than one time, or a discussion supported by writing on the whiteboard in the classroom. When the students are stuck, they can use digital sources or books. Peter also uses repetition, and the two whiteboards in the classroom are important. Content can be left until all the students think that they know it. He is also careful to involve the students in writing at the white board so that the content is relevant to them. Anna also uses the whiteboard to enhance comprehensibility. When teaching about nutrition, the students´ first answer questions individually on their own mini-whiteboards, then discuss with a friend, and finally they brainstorm together on the whiteboard in class. In the next step, Anna erases the brainstorming and projects the correct answers from the book onto the same whiteboard with a power point. This is something that she considered to have a good potential for learning something difficult.

The knowledge and experience of the teacher

Data displays many examples where the teacher's experiences and knowledge are highlighted. Peter said: "It starts with the teacher, because if the teacher has a deep and broad knowledge, a high level of professional skills, he can make the content comprehensible for the students, he can take the essence out of it." Here, procedural knowledge is iteratively illustrated in the data. In relation to this, Anna reflected upon the two different professional roles she is oscillating between. She often refers to her own experiences of situations of learning techniques or procedures in the industry. Also, Rebecka sees herself as crucial for comprehensibility, as illustrated by: "The schoolbook part, it never really corresponds to reality". Therefore, she is eager to prepare the students for situations where prerequisites can change fast, and the students need to be prepared to act and to know when to act: "It is a matter of life and death". Similarly, Peter often highlights that as an electrician, you need to work under time pressure, meaning you

must plan your work, make sure everything is in place, and do things in the right order. This is a knowledge that is dependent on the experiences of the teachers.

Storytelling

Peter, Anna, and Rebecka all tell stories of situations they have experienced in working life. Peter emphasizes the idea of extremes, and social interactions are highlighted both for learning in the classroom but also for working as an electrician. He takes the role of the customer, and he vividly describes the customer as a rich noble person with expensive carpets in the mansion, or the stingy customer from the neighboring village that does not want to pay anything. One morning, some of the students suddenly had laminated and framed pictures in their working booth that represented an old grandmother, or a successful businessman. Peter had placed them there for several reasons. He thought that telling a story of a person would enhance the meaningfulness when the students saw their customer in the window; it would also enhance communication between the students and him. Furthermore, it was a way to increase the difficulty in the project because a window was placed for the students to work around with their cables. In the same descriptive way, the story about Anna scoping butter for hours in a restaurant abroad, or Rebecka telling a story about a sad patient that had been mistreated by a colleague, served as stories to enhance a message.

To summarize the findings, the sociomaterial manifestations of vocational teachers' reflections revolve around three themes: i) Materials, ii) Connection to working life and iii) Human relations and interaction. Sociomaterial manifestations include a wide range of materials, also the teachers themselves. Teachers experience trouble in relation to technology; however, make use of technology they have at hand here and now. Materials that support adjusting teaching to the students' needs, as well as embodying experiences and routines from working life, are reflected on as especially useful.

Discussion

Vocational teachers navigating complexity, due to dual professional roles and teaching contexts (Kilbrink et al., 2023; Lahn & Berntsen, 2023) and complex competences (Antera, 2023; Leonardsen, 2023), can be understood from a both a sociomaterial and a SOC perspective. In other words, vocational teachers aim at applying SOC to navigate sociomaterial complexity. Thus, the discussion draws on both perspectives. A wide range of teaching materials, as well as interaction among teachers and students, constitutes an inherently inseparable sociomaterial environment. Moreover, the teachers and the students *are* the teaching material. Other materials are to be seen as props making teaching possible, but human relations give them meaning.

A sense of coherence perspective in vocational, sociomaterial, teaching practice

The aspects of SOC, meaningfulness, manageability, and comprehensibility can help in understanding the findings. When vocational teachers teach and reflect upon their teaching, *meaningfulness*, which refers to motivational aspects, is highly involved. Vocational teachers

reflect on the connection to working life together with vocational materials and the teacher's creativity, passion, and experiences. Materials that support roleplaying, relations, and connection to working life are all described as meaningful for the students. So are the mundane technologies students are already familiar with. *Manageability* refers to experiencing sufficient resources to cope with the situation. Teachers highlight the lack of, and the need for, manageability for the students when it comes to teaching materials. Technological trouble presents obstacles, especially in relation to digital technology. Materials that support lesson planning, embodied routines that enhance procedural knowledge, communication with and adjustments for students are described as useful. Furthermore, vocational teachers stress the human relations and emotions in the classroom as crucial for manageability. A part of that has to do with the teachers' own work experience and at the same time a focus on students' needs. Sometimes, teaching materials are experienced as enhancing manageability, especially mundane technology; however, often the opposite is true. *Comprehensibility* is understood as learners' capacity to understand the challenge or the task. Examples of how teachers strive for the students' comprehensibility when choosing teaching materials are many but, at the same time, the teachers *are the material*. The comprehensibility of the teacher is understood by all three informants as crucial to make the content comprehensible for the students.

This study has shown that vocational teachers are aiming at making teaching meaningful, manageable and comprehensible for the students. A wide range of materials is crucial to support the embodied knowledge and routines that teachers find useful, in the vocational teaching practice. This is in line with previous research (Wyszynska Johansson, 2024, Kilbrink, 2021). Drawing on sociomateriality (Orlikowski, 2007), both vocational teachers and their students must make sense of technology to use it. The understanding of humans and technology as mutually entangled is evident. Often, they favor analogue material, or they and the students´ *are* the teaching material. The motives for leaning towards analogue or mundane material could be that the teachers deal with a lot of uncertainty due to changes in working life (Andersson & Köpsén, 2019; Köpsén, 2014) as well as in the classroom (Frelin, 2013; Osberg & Biesta, 2007) and teaching happens here and now (Asplund, 2021*)*. Thus, teaching materials that can contribute to vocational students' SOC here and now are more likely to be adopted by teachers. There are several examples of using digital technologies and even if the technologies introduce challenges, they still are experienced as meaningful, manageable, and comprehensible by the teachers and therefore they use them. The mundane technologies, such as social media and smartphones, are seemingly easier to adopt than a new learning management system or new vocation-specific technology. The frequent vocational-specific teaching materials, such as digital technologies, clothes, and tools, are seen as support for SOC. However, the accessible technologies are hardly new. New vocation-specific technologies are often difficult to adopt (Carlsson & Willermark, 2023). So even if they are part of the subject in the meaning of digitalization as vocational knowledge, they cannot always contribute as didactical tools. The new technologies might be meaningful for the teachers because of their connection to working life, yet not seen as useful in their teaching. This is in line with previous research emphasizing the different curricula in vocational education and in working life (Billett, 2006; Carlgren, 2017). Keeping up with a rapidly changing working life and digital developments, mentioned as stressful in research (Cattaneo et al., 2022; Enochsson et al., 2019; Nyström & Ahn, 2020), is therefore continuously difficult.

Drawing on sociomateriality (Fenwick, 2015), the vocational teacher, as teaching material, conveys knowledge and becomes performative. This means that if we argue for vocational teaching practice that should prepare students for a rapidly changing working life, we need to argue for a teaching that acknowledges SOC here and now, as well as the vocational teacher as teaching material among other props. Such a teaching practice has the potential to navigate the different curricula, that both takes students' varying needs, as well as keeping up with a rapidly changing working life, into consideration.

Conclusion

This study sheds light on in-service vocational teachers' reflections on how different teaching materials can enhance vocational students' SOC. The sociomaterial manifestations of vocational teachers' reflections revolve around three themes: i) Materials, ii) Connection to working life and iii) Human relations and interaction. The connection to working life as well as human relations and interactions are to be seen as crucial in a sociomaterial vocational teaching. This way of integrating work in teaching practice is manifested through a wide range of materials, including the vocational teacher. Materials supporting a vocational didactic that *here and now* takes all the aspects of meaningfulness, manageability, and comprehensibility into consideration are suggested. Thus, SOC is understood as a way to navigate sociomaterial complexity in vocational teaching.

Future research should consider the role of teaching materials when connecting different school-based vocational learning environments as well as explore the potential for vocational teachers to learn about and integrate new vocational technologies into their teaching. It would also be of value to take a student perspective on SOC in vocational teaching.

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