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Learning team-based quality improvement in a virtual setting: a qualitative study

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ABSTRACT

Objective The objective was to explore students' perceptions of learning quality improvement (QI) in a virtual setting and identify factors that promote or inhibit virtual learning.

Design We used an exploratory case study design with focus group interviews. The data were analysed using a thematic analysis approach, with an analytical framework derived from activity theory and Bloom's revised taxonomy of six categories of cognitive processes of learning.

Setting Postgraduate students participating in a virtual 1-day simulation module to learn QI at two universities in Norway.

Participants Four focus groups with a total of 12 participants.

Results The students' descriptions of learning outcomes indicate that the learning activity involved a variety of cognitive activities, including higher-order cognitive processes. We identified three themes pertaining to the students' experiences of the virtual learning activity: learning through active participation, constructing a virtual learning opportunity and creating a virtual learning environment. The students described that participation and active engagement led to a greater understanding and an integration of theory and practical improvement skills. They reported that to engage in the virtual learning opportunity, it was necessary to create a learning environment where they felt psychologically safe.

Conclusion Our findings indicate that it is possible to facilitate collaborative learning integrating theoretical knowledge and practical skills in a virtual setting. Students experienced that engaging in the virtual learning activity contributed to the integration of theoretical knowledge and practical skills. Psychological safety seems to be important for students' engagement in the virtual learning activity. A virtual learning environment alters prior common norms for interaction based on physical presence, which in turn affect students feeling of psychological safety. Educators need to be aware of this and facilitate a virtual learning environment where students feel comfortable to engage.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study has gathered qualitative data from an educational context that has not previously been studied, that of virtual simulation of quality improvement work.
⇒ We use a robust theoretical framework to analyse how the virtual setting impacted the learning situation.
⇒ We did not measure learning outcomes using a typology with predefined criteria, rather we relied on students' self-reported perceptions of learning.
⇒ We have provided detailed information about the research context to ensure transferability.

INTRODUCTION

Virtual learning has become more commonplace in higher education as digital tools supporting remote learning have evolved. The COVID-19 pandemic further necessitated a break from traditional classroom teaching. Alternative learning activities have emerged that seek to adapt traditional teaching and learning activities to a virtual setting.[1] However, for learning that implies the use of practical skills and active collaboration with others, virtual learning can have general disadvantages compared with traditional learning with physical presence. Disadvantages that have been noted are mainly related to the risk of increased student passiveness, which can weaken motivation for learning, encumber communication between teachers and students, and reduce the students' opportunities for communicating about their knowledge.[2]

Quality improvement (QI) has been defined as 'the combined and unceasing efforts of everyone—healthcare professionals, patients and their families, researchers, payers, planners and educators—to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development'.[3] It is considered a fundamental core competence for healthcare professionals,[4] and teaching QI has over the past years become commonplace in education programmes.[5]

QI competence is based on the integration of different types of knowledge and skills and

the ability to apply this competence in authentic clinical contexts to improve care delivery.[3 6 7]

Thus, it is necessary that students engage in higher-order cognitive processes in which they not merely remember and understand, but are able to analyse, apply, evaluate and create.[8–10] Moreover, real life QI work hinges on interprofessional collaboration. QI education for healthcare professionals therefore typically combines didactic and experiential learning approaches that involve simulation and problem-solving.[6]

The experiential learning activities in which students apply and integrate QI knowledge and skills in clinical settings are often delivered as small-group work. Examples of activities are drawing flow charts to decide the steps of existing or recommended care processes, developing fish-bone diagrams to organise expected cause-and-effect relationships, and analysing results using linear time series diagrams. As effective QI is dependent on applying competence in collaboration with others and applying it in a clinical setting,[11 12] this part of the QI training has dominantly been seen as dependent on the physical presence of students and teachers.[1 6]

Khurshid *et al*[1] have explored to what degree students can learn QI skills using digital platforms. They find that the educational approach most frequently documented has been that of online courses without real-time feedback from fellow students or teachers, either delivered as stand-alone courses or to be completed in preparation for class.[1] Few studies have so far explored how the collaborative part of QI competence can be learnt virtually and if students can achieve the necessary higher-order level of learning from a virtual course. Further, we have limited knowledge about factors that promote virtual learning of QI competence.

In this study, we have explored collaborative learning without physical presence using QI as a case. We designed a complex virtual QI learning module for healthcare professionals enrolled in postgraduate studies at two different higher education institutions in Norway. We sought to create a module that simulated interprofessional collaboration, integration of QI skills and knowledge, and translation of QI competence to actual improvement work in a clinical setting. The objective of the study was to explore students' experiences and perceptions of learning QI competence after participating in the virtual learning module, and to identify factors that promote or inhibit virtual learning of QI competence.

MATERIAL AND METHODS

Study design

Employing an exploratory case study design,[13] we conducted focus group interviews with students to explore their experiences with a virtual QI learning activity. The qualitative design was chosen to obtain in-depth information concerning the students' perceptions of what and how they learnt in the virtual, social setting. Learning is, in this study, viewed as a sociocultural process.[14 15] Through discussion and active participation, students develop their knowledge and skills, both individually and as a group. Collaboration between educator and students, and between students, is necessary for learning to happen. Our choice of gathering data through group interviews, rather than individual interviews, was based on our wish to access collective interpretation of such learning.

Context and module characteristics

The virtual learning module was introduced into the curriculum of post graduate courses for healthcare and social services providers at two different higher education (HE) institutions (hereafter HE1 and HE2). The students were experienced health professionals employed in positions as health workers or managers in hospitals or other healthcare or social services. There were 30 and 25 students enrolled in the courses at HE1 HE2, respectively. Most students were between the ages of 30 and 55, and a vast majority (>90%) were female. At both HE institutions, the virtual learning module conducted over the Zoom platform, replaced prior classroom teaching due to the COVID-19 pandemic. Three of the authors were involved with teaching the module: MH and EH taught at HE1 and GH and EH taught at HE2.

At HE1 the course all together consisted of 4-week long sessions spread out over half a year. The virtual learning module addressed in this study took place during the second week. At HE2 the course consisted of five 2-day sessions spread out over half a year. The virtual learning module addressed in this study took place during the fifth session. Earlier in the course the students had been taught about QI theories and how to apply QI skills and techniques like drawing process charts and analysing performance data. Due to the pandemic, the previous teaching had been a mixture of virtual and physical presence.

The main learning objective of the module addressed in this study was to integrate theoretical and practical QI skills and knowledge through simulation of interprofessional collaboration in a clinical setting. The module lasted for one full day. Students joined in groups of four to six. Each group worked with a specific scenario: They were to act out as a QI team in a specific type of healthcare or welfare services organisation and handle a specific quality issue pertaining to suboptimal performance, for example, poor follow-up of nutritional status for older patients receiving home care or delayed surgery for patients with femoral neck fracture. The students chose between five scenarios, based on their interests.

The structure of the module alternated between whole class instruction, working in groups and presenting the group work to the rest of the class. Following a step-by-step approach inspired by the model for improvement,[16] the groups had to identify the quality problems, standardise the clinical work process, define interventions, develop process and outcome indicators, and analyse their results. The module was interactive and dynamic in that the groups received guidance from two teachers

and feedback on their work from the teachers and fellow students in the plenary sessions. Moreover, the teachers sent each group unique before and before-and-after datasets describing artificial scores of the group's suggested indicators. To facilitate the online collaboration, the students used digital worksheets and templates for drawing process maps.

Recruiting participants and conducting interviews

All students at the two courses received invitations to take part in the study, and all who accepted the invitations were included in the study. To avoid any pretence of pressure, reward or punishment in connection with participating in the interviews, recruitment was conducted by an administrative assistant at HE1 and HE2. GH and MH interviewed students from the course they did not teach. It was made clear to the participants that the teachers would not know which students had volunteered to participate in the interviews.

We performed four focus group interviews: three with students from HE1 and one with students from HE2. There were 3 participants in each focus group, that is, 12 participants in all (11 female and 1 male). The interviewees came from different services, including specialised hospital care and primary care, and all had several years of work experience. The interviews were conducted via Zoom and Microsoft Teams. The interviews lasted for around 1 hour. We used a semistructured interview guide that EH, MH and GH developed (online supplemental file 1).

Analysis

Deidentified transcripts of the audio files from the interviews were analysed using thematic analysis.[17] Our approach can be described as theory-informing inductive.[18] Initially, all authors read the transcripts to familiarise ourselves with the interviews and identify potential themes of interest. Then we used Bloom's revised taxonomy[10] as an analytical framework to explore the students' descriptions of what they had learnt. This taxonomy distinguishes between six categories of cognitive processes of learning: remembering and understanding, applying, analysing, evaluating and creating.

Based on the overview from the initial, inductive phase, we found it expedient to support our analysis with Engestrøm's[19] activity system as an analyticl framework to explore factors that promote or inhibit virtual learning of QI competence. According to Engestrøm,[19] an activity system has six dimensions: individuals in an activity, their tools, objectives, division of labour, the rules of the system that governs their actions, and the communities in which they participate.[19] These dimensions represent mediators for learning that are mutually interdependent. A change in one dimension can thus alter the other dimensions. In a virtual setting, for example, one uses tools that are different from those used in an ordinary classroom, and according to activity theory this can influence the other dimensions.

In order to explore factors that influenced the learning, we used the main constructs of the activity system[19] to support the coding of the data. Then we added codes derived from the data.[20] The coding and development of themes were reviewed and revised based on a consensus process among the four authors.

Reflexivity

Researching one's own teaching practices requires self-awareness. We investigated students' assessments of a module we developed and, to some degree, of our merits as teachers. Early in the research process we reflected together on our expectations and how we could influence the research. To mitigate some of the potential bindings and biases, we decided to blind the researchers from recognising their own students in the material. In addition, we did not interview our own students, and all information enabling the identification of respondents was eliminated from the transcripts. We also included a fourth coauthor (EAV) into the research project. Not having prior commitment to or experience from these courses, he could act as a counterweight to any interpretations that suggested a myopic or self-deserving viewpoint. This stimulated reflexive awareness throughout our work with the article.

Patient and public involvement

Patients or the public were not involved in developing and conducting this study.

RESULTS

The students' descriptions of learning outcomes indicate that the learning activity contributed to a variety of cognitive activities including higher-order cognitive processes. We identified three themes pertaining to how the students experienced the learning activity: learning through active participation, constructing a virtual learning opportunity and creating a virtual learning environment.

The students described how they engaged in the learning using a wide variety of cognitive processes. They described gaining specific skills to create flow charts and define indicators, as well as more advanced learning such as applying theories and methods to their real-life clinical setting. They also reflected on contextual and behavioural factors that could promote or inhibit their learning. Moreover, they described activities they found useful for improving their learning. In table 1, we provide examples of students description of their learning, categorised by Anderson and Krathwohl's revised version of Bloom's taxonomy for categories of cognitive processes for learning.[10]

The three themes that emerged when analysing factors students described as relevant for learning in the virtual simulation module, are interdependent. The students needed to construct a virtual learning opportunity through using a digital platform that could facilitate learning. To engage themselves in the virtual learning

Table 1 Examples of what the students described having learnt after participating in the virtual learning module, categorised by the cognitive processes as defined by Anderson and Krathwohl[10]

	Description	Examples of quotes by students
Remember and understand	Gaining skills and understanding how to use tools and conduct different steps in a QI process	► …learning the different steps of an improvement process, from a to z.(2A) ► Drawing flow chart, I found that really interesting and educative (…) finding that we also needed to define the sub-processes (2C) ► Defining the stars [dimensions of quality], employing flow chart, looking at Fishbone-diagram and things like that, for me that was really useful. (3A)
Apply	Being able to adapt the QI tools and methods to other settings and seeing how digital tools can be used to facilitate QI efforts.	► learning theories…how to use them. In a way, seeing the improvement process as a whole and helping us to use it in our everyday work later on. (4A) ► I've used the model at my work many times afterwards. It was like a huge Eureka for me to use the digital platform in the way we did (2A)
Analyse	Recognising tools and theories, learnt about separately, and seeing how they constitute a coherent method.	► using the flow chart…How important it is to understand the different steps of the process to know how to affect…how to make decisions (1A) ► when we analyzed the data we found no improvement (…) What can we do now, how can we design better interventions that will lead to improvement, that changes the practice, you know (4C)
Evaluate	Choosing and employing theories and tools to evaluate existing practice for QI at their working place.	► [the learning activity] stimulated to reflect upon and understand how to apply the theories… because the more we are stuck in our own practice, the more we are restricted by our own blind spots, I believe (2A) ► I was at work (…) saw how [a colleague presenting a QI project] did many things right, but also many things that could have been done better. (…) when he started to be unclear, mixing things together, you are…I was able to understand because I have the knowledge. (4A) ► …when writing my assignment, I will use what I've learnt and, later on, use it at work. (4A)
Create	Adapting theories and tools to define a coherent plan and gaining skills for interprofessional cooperation in a QI team.	► …learning to be a part of the improvement team which include a set of different roles. (2A) ► …many things that can be transferred [to own place of working], both practical process improvement and knowledge about what leads to organizational change, what stimulate learning, how to implement new practices, you know…and how to practice this. So, yes, I believe I've gained a deeper insight into QI and clinical practice than I had before… (4A) ► sitting passive and taking notes…a totally different thing to work with it as we did… It is about making it to my own and putting it into a system with what I already understand. (3B)

The quotes are marked with the interview number and a letter representing the participant.
QI, quality improvement.

opportunity, the students reported that it was necessary to create a learning environment where they felt psychologically safe. In the following we will elaborate on these three themes.

Learning through active participation

The students reported that creating a learning environment in a virtual setting called for an individually felt responsibility and discipline to take part and engage themselves in the digital learning activity. Attending class while sitting at home, students experienced having to take steps to avoid distractions:

> At one moment I realized: I need to take action. It was so easy to drift away. Therefore, (…) I had the camera on constantly because then I had one more reason to be, in a way, more 'logged on' (…) [I decided] the phone has to go, the dog has to go, the knitting tools have to go, and then I have to pay attention and engage myself. (3E)

The students described that participating and actively engaging themselves in the learning activity led to a greater understanding and integration of theory and practical improvement skills. They found that the case-based simulation approach necessitated an active application of improvement techniques and methods. The students valued how the learning activity enabled practical use and integration of theory, models and tools in a way that they had not experienced through previous ordinary classroom teaching. Asked whether they thought the learning activity was a form of practical exercise or if it was a way to enhance understanding, one respondent answered that it 'turned into a mix' of the two:

> … because when you do it in practice, you actually understand it better; you see the consequences, in a

way; you get a better view of the workflow. So personally, I believe I learned a lot that day, because at that point I understood how everything is related. You have, in a way, applied the theory, right? (4C)

The students cooperated within groups to address the quality problems described in their case. Group members were given a role (eg, nurse, medical doctor or patient representative) to conduct a stepwise improvement process together. This was described as important and to some degree as an eye-opening experience. The students felt they could improve their social skills in leading and operating in a group tasked with accomplishing QI. The combination of group work in digital breakout rooms and whole-class sessions for presentation and feedback was emphasised as important by the students. They explained how they used each other and the two teachers to understand theories and methods and to apply these to their case. Guidance and feedback from the teachers helped adjust the work in the groups when it was needed, thereby contributing to reflection and learning.

…then [the teacher] came and listen to us and asked…(…) In a way it was so obvious when he said it, but we hadn't got there yet. For me, this was like… very educative. (4C)

Working in groups was also considered important because the students had different backgrounds, which enabled them to offer different perspectives on how to address the challenges presented in the cases and assignments. This, in turn, facilitated engagement and learning.

(…) become abundantly clear to me (…) that we don't think improvement… that is to say, in our organization, we think of improvement in our separate silos. And that was the fun of the composition of the groups: that there were such differences, with such differing backgrounds as it were, which made one see the usefulness of doing improvement work not only for physicians or only for nurses. (3A)

The group members held each other accountable for completing the designated assignments for each group session so that they were ready to present to the other groups in whole-class sessions.

You know, after each group session there was feedback in plenum, so you had to sort of come up with something. Not all groups had to [hold a presentation for the rest of the class] in every session, but you could risk that now it was your turn. (3C)

Constructing a virtual learning opportunity

Mastering the digital platform and having sufficient digital competence to make it work was essential for learning, according to the students. Technical problems were reported as stressful and distracting. Some students felt that encountering technical problems and troubleshooting technical issues in front of the entire class was a waste of time, and a little embarrassing.

We learnt along the way, but the technical issues… where is that document… I downloaded a pdf version, but I needed a Power Point version… it created technical stress which was problematic. (2A)

…when you are about to join the whole class [for the purpose of presenting the work of your group], you really want to master the technology. Or else you risk losing many minutes during these sessions simply working on getting technical issues in order. (2B)

The technical problems were, however, experienced as a temporary nuisance. Being required to learn how to use the digital platform and tools developed for the learning activity, and using the competence within the group, was reported to solve most of the problems. The digital tools were also considered as an advantage by some students, in that they enabled them to work more efficiently and get more done in a shorter time once they had mastered the digital platform.

First student: We are more efficient when working on Zoom, and I like that. (4C)

Second student: A lot more efficient, you can use the time more effectively, and for me that is crucial since I also have to manage my ordinary job, my kids, the house, and everything else. Efficient use of time, that is entirely tip top. (4B)

The cases with the corresponding assignments and digital tools were essential for constructing the learning opportunity on which improvement techniques and methods could be applied. The students valued the interactive and dynamic digital cooperation. The students planned the improvement and requested and received data that altered the state of their fictional case, which they had to address and react on.

I found that the cases and the assignments were effective, because it is like you say (name of fellow student) we experienced receiving data showing a poor result, so it was in a way a very dynamic project. And I do not really think it would have been more dynamic if we had been sitting together in the same place physically. (4A)

Creating a virtual learning environment

The students described that it was important to feel included and safe to participate in the group work and the learning activity. They pointed out that it was possible to feel safe also in a virtual learning environment, but it required different actions compared with a physical setting.

From my perspective I learnt a lot that day because I know the other group members and I feel safe and that I can trust them. On that occasion, we had just had a hefty and busy week where we had been

switching back and forth between many different groups. So, for me it is crucial to feel safe in order to discuss with the other group members. (2B)

Working in groups was one factor that contributed to a feeling of safety. Being in the same group over time was considered important to create stability and getting to know one another, and the groups should not be too large. Once the students got to know one another, they experienced that the groups' capacity for learning improved. Having cameras turned on during the whole session was considered important to understand the body language and feel a connection to the learning community.

When we switched from physical to a virtual setting, I became really uncertain about the norms for virtual learning. […] In a physical classroom the threshold for speaking up is lower, and when we moved to a digital setting, I became concerned with whether I became too dominant. […] … in the end I personally didn't spend that much energy on [worrying]. Because then I felt like things had settled down so much and people had different roles and it seemed OK. Then it gets a bit like sitting in a classroom, only that one does so virtually. (3A)

When you take a break from digital learning you leave the screen, instead of taking the break while going to the coffee machine talking to the person next to you. It is easier to get to know the other students that way when you talk face-to-face […] and the focus is not only on the subject [being taught], [rather on] What do I get out of this? What have you been reading? And so on. (3B).

…and I think it is very important to keep the cameras on. […] Especially, if there is a conflict. One becomes really uncertain then, because you cannot read the body language. And all of a sudden there is an unexpected reaction from a black screen, which makes things really unpleasant. (3B)

Switching to virtual learning created some uncertainty and increased self-awareness, until the students understood the norms of the new setting and felt comfortable in it. The students described that it was important that the teachers established ground rules for behaviour in the digital learning module and were aware of how they could engage and connect with the students and facilitate processes where students could engage with one another.

…both EH and MH said that they wanted us to keep the cameras on. And I think that was extremely important. (…) when you have the camera turned off you do not need to concentrate and engage yourself. You are forced to being more present if you have the camera turned on. So I think it is incredibly important during this kind of virtual teaching or meetings, that everybody actually agree that here you are supposed to be present and the camera needs to be on. (3C)

During the virtual learning module, the students also initiated group activities that contributed to a feeling of belonging to a community.

First student: You should have been there, it was the group work of a lifetime, closing with a song. [Student] had a solo. It was outstanding. (3B)

Second student: It was incredibly good. I went around humming [the song] the whole weekend. (3C)

DISCUSSION

In this study, we explored students' experiences and perceptions of learning QI competence after participating in the virtual learning module, seeking to identify factors that promote or inhibit virtual learning of QI competence. Learning QI is an example of a case where students need to integrate theoretical knowledge and practical skills and apply them in a real life setting in collaboration with others. Previous research argues that in situ simulation can be a suitable learning activity for such integration of knowledge and practical skills.[21] Our findings indicate that students were able to meaningfully engage in collaborative learning in a virtual setting. The collaborative learning was dependent on creating a virtual learning opportunity and an expedient, virtual learning environment.

The students' descriptions of what they learnt during the virtual module indicate that the learning process was not merely about remembering and understanding, that is, the lower-order cognitive processes. The virtual learning activity also seemed to facilitate more complex cognitive processes, such as evaluating and creating.[10] Our findings thus indicate that it might be possible to recreate some of the benefits of in situ simulation and student engagement in a virtual learning setting.

QI is dependent on improving the clinical system delivering the care and its interdependencies. Its success thus hinges on interprofessional collaboration.[22 23] The students described how the learning activity contributed to an understanding of the necessity of interprofessional collaboration to improve care delivery in a real-life setting. Their experiences of insight and training in such collaboration, even though the activity was conducted virtually using a case, is therefore important. It helped them reflect on how they approached improvement in their own real-life work situations. Our findings do however not imply that the students were able to directly translate this experience into actual interprofessional improvement work in a real-life setting.

We found activity theory helpful to shed light on how different factors involved in creating a virtual learning opportunity and a digital learning environment mutually impacted one another.[19] We found that creating a complex virtual learning situation setting impacted the constructs 'rules' and 'community'. Our findings show that the common norms that apply in a physical setting cannot be directly applied in a virtual setting. An essential part of the

learning activity took place in groups consisting of four to six students. In the interviews, the students described psychological safety to be important for engaging in the learning activity. Team psychological safety, which can be defined as a shared belief that the team is safe for interpersonal risk taking, has been shown to be associated with learning in teams.[24 25] While previous research has found that online learning can provide a safe place for students to express opinions that they would not do face to face,[26] our results suggest that increased psychological safety in online learning should not be taken for granted. We found that psychological safety could be developed in a virtual setting, but it required different actions by students and teachers compared with a physical setting. In the digital setting the students, for instance, lose out on breaks and small talk that contribute to psychological safety.[27]

Our findings indicate that both students and educators can play a role in facilitating a learning environment contributing to psychological safety. In our study, activities that contributed to a sense of belonging to a community also contributed to psychological safety, for example working and collaborating in smaller groups. On a digital platform one can effortlessly create breakout sessions with smaller groups of students. The students reported that frequent shifts in group composition had a negative impact on the learning environment and the feeling of psychological safety, and that the groups in this course should not be too large. The students expressed the importance of the educators facilitating and promoting student engagement and the importance of sharing experiences with one another in groups and plenary sessions. Our findings indicate that teachers should actively encourage participation in a way that does not feel threatening for the students, and that positive feedback can promote psychological safety and student participation. The students themselves could also play a vital role in developing a sense of psychological safety and belonging to a community. Having their cameras on helped them focus their attention and commit themselves to collaboration and contributed to a sense of collective community. It is also worth noting how unconventional student activities like performing a group song, which was not directly linked to the learning process, influenced the students' sense of belonging.

Strengths and limitations

Given the extensive and rapidly increasing use of digital tools for educative purposes, we need more knowledge about the possibilities, limitations and prerequisites for virtual learning of complex competences such as QI competence. The main strength of our study is that it provides insights into a form of virtual education that has only to a limited extent been addressed in previous research. The study shows that learning QI in a virtual setting can be beneficial for students, and it highlights potential obstacles and the importance of adjustments and facilitation by both the teachers and the students. Moreover, we use a robust theoretical framework to analyse how to create a virtual learning opportunity and an environment that can foster interprofessional collaboration and application of QI competence in a clinical setting.

A limitation of our approach is that we used the participants' statements as indicators for learning. Since this is an exploratory case study in which we have sought to learn more about factors influencing learning in a virtual setting, this limitation does not invalidate the findings regarding facilitating and hindering factors. However, the findings regarding achieved learning outcomes should be interpreted with due caution. The data selection poses another limitation to this study, related to the transferability of our findings. The responders were highly motivated students who had actively applied to be accepted to the master programmes and had many years of work experience. The sample consisted of two cases from a similar educational context. We do not know to what degree our findings are transferable to other students and settings. To facilitate transferability of our findings, we have included detailed information about research context. Further research should explore how different virtual teaching strategies can be used in different contexts and with different groups of students to facilitate collaborative learning.

CONCLUSION AND IMPLICATIONS

Our findings indicate that it might be possible to facilitate collaborative learning integrating theoretical knowledge and practical skills in a virtual setting. Students experienced that the virtual learning activity enabled them to engage in learning activities that contributed to the integration of theoretical knowledge and practical skills.

Psychological safety seems to be important for students' engagement in the virtual learning activity. A virtual learning environment alters prior common norms for interaction based on physical presence, which in turn affect students feeling of psychological safety. Educators need to be aware of this and facilitate a virtual learning environment where students feel comfortable to engage.

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Contributors EH, MH, GH and EAV participated in the design of the study. GH and MH conducted the interviews. All authors participated in the analysis and drafting the article. All authors participated in the critical revision of the manuscript's intellectual content. All authors read and approved the final manuscript. EH is the author responsible for the overall content as a guarantor.

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Patient consent for publication Not applicable.

Ethics approval The study protocol was reviewed by the Norwegian Centre for Research Data, which assessed ethical aspects of the study related to collecting and handling the data (voluntary participation based on informed consent, information provided to participants, the anonymity of informants and the presence

of appropriate data storage protocols; project number 701697). All interviewees received written information describing the research project before they gave informed consent to participate. The consents were documented in writing or, if given orally, through audiorecording.

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