Article

"It Enables Us to Reflect More on Nutrition": A Mixed Methods Cross-Sectional Study on Preclinical Digital Training in Nurse Education

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Abstract: Adequate nutrition is a basic human right, yet older adults are at high risk of malnutrition. Nutrition is not a part of most nursing curricula. Limited research has been done on digital case-based learning (CBL) in breakout rooms (digital groups); therefore, the aim was to develop and evaluate a preclinical digital CBL unit (3-h synchronously and with an asynchronously flipped classrooms approach) for prevention and treatment of malnutrition and to explore nursing students' experiences and learning outcomes. Different scenarios for two fictive cases were created in which malnutrition-related challenges were included (such as terminal care) and embedded on the ThingLink platform. In an explorative mixed methods cross-sectional study design, students (n = 78) completed an online evaluation. The results revealed that students wanted more synchronous interaction with educators and less time alone in breakout rooms due to their peers being unprepared, passive and unfamiliar and not turning on their cameras or logging on too late. The learning outcome from quizzes and word clouds were high, but the added pedagogical value of ThingLink seemed low. This explorative study sheds light on central issues related to the use of technology in nurse education, resistance against student active methods and digital pedagogy.

Keywords: nurses; active learning; education; distance; malnutrition; breakout rooms; nurse training school; older adults; interprofessional education

1. Introduction

1.1. The Impact of Malnutrition among the Older Adults in Affluent Countries

Malnutrition increases the risk of disease, longer convalescence and poorer quality of life in addition to raising the burden of care and increasing medical costs. Adequate nutrition is a basic human right and an essential part of patient safety [1]. As of today, there is no standard method for diagnosing malnutrition, and data on the incidence of malnutrition varies with the method used, as well as with the population examined. In addition, a distinction is often not made between "malnutrition" and "risk of malnutrition", or the terminology is not used consistently. According to both international studies, around 23% of Europeans are at risk of malnutrition [2]. The proportion at risk varies between departments, between diagnoses and between severity of illness, with the highest proportions found among patients with cancer diagnoses, patients with lung diseases, patients with serious infections and patients with diseases of the digestive system. Older adult individuals have a higher risk of nutritional deficiencies because aging may come with an accumulation of diseases and impairments [3]. All patients at risk of malnutrition should have an individualized nutrition care plan, including documentation of nutritional status, needs, dietary intake and recommended treatment [3]. Patients at high nutritional risk or who are malnourished should be provided with a protein-energy enriched diet [4]. Despite both international [1,5] and national guidelines [6] for prevention and treatment of malnutrition, the condition continues to be prevalent [7].

1.2. The Gap in Nurse Education, Official Guidelines and Clinical Practice

Although nurses constitute the largest portion of the labor force in health care, prevention and treatment of malnutrition is not included in the curricula of nearly 30% of European educational nursing institutions [8]. The result is that nurses graduate with poor nutrition knowledge and malnutrition management practices [9]. Well-recognized barriers to good nutritional care among nurses include knowledge, skills and competencies related to all parts of adequate nutritional practice [1,2,10]. The gap between nursing education, official guidelines and clinical practice is challenging [4]. Adequate preclinical nutritional training may fill these gaps.

1.3. A Digital CBL Approach for Bridging the Gap

Traditionally, case-based learning (CBL) in small groups is often used in nursing education as it gives students active learning experience that resembles teamwork in health care and learning outcomes [11]. The goal of CBL is often described as "to prepare students for clinical practice, using authentic clinical cases. It links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods" [11]. Nurse education has been lagging behind in the digital transformation of education, and more knowledge of different digital pedagogical approaches is needed to improve learning designs [12–14]. Video conferencing platforms with breakout rooms provide new opportunities for active digital group work for students, and they have been found to give equal or higher levels of learning achievement, problem-solving skills, collaborative learning and interaction compared to streamed online classes using traditional teacher-based methods [15]. When contrasted to face-to-face, in-person learning on campus, some challenges include discussions that tend to take longer, peers who may not turn on the camera or those peers who remain muted. Furthermore, students may feel uncomfortable because they might not see each other if the screen is shared or if the group size is large, and they may also get "Zoom fatigue" [16,17]. Frequent breaks, shorter sessions and use of student response systems (SRSs) have been suggested to combat fatigue and increase learning outcomes and satisfaction [16,18]. To the best of our knowledge, no published research exists on learning outcomes from small-group CBL in breakout rooms in preclinical nurse training.

The aim of this study is to develop a new digital CBL unit for the prevention and treatment of malnutrition and to explore nursing students' experiences and learning outcomes from first-time delivery.

2. Materials and Methods

2.1. Setting and Students

This study is based on data derived from the largest nurse education course in Norway (750 students annually) at Oslo Metropolitan University (OsloMet). A digital preclinical learning unit focusing on malnutrition in older adults and patient safety was developed through multidisciplinary collaboration between nurses and clinical dietitians from both OsloMet and the working field. Due to the merging of two different nursing study programs from two different campuses, approximately one-half (*n* = 309) of second-year nursing students in August 2021 were invited to participate in the present study. No inclusion criteria were applied. The hospital practice is only in the second year. Learning outcomes of patient safety and nutrition are a focus in their curricula in nurse education [19], and participation would give them relevant preclinical training before they entered their clinical studies in medical and surgical wards at hospitals.

2.2. The Digital Learning Unit

The digital learning unit (1 ECTS) was divided into an individual flipped classroom (asynchronous) approach and a real time (synchronous) collaborative learning approach through a voluntary 3-h breakout room seminar on Zoom on 18 August 2021 (Table 1). SRS (quizzes, Mentimeter word clouds and ThingLink) was used to help to engage students with the learning content. ThingLink is an online tool for creating interactive images and

videos by adding tags, which may be embedded in LMS. Tags can link to videos, maps, images, social media pages, websites and audio. The case-based small-group learning design was based on previous studies from OsloMet, both using small-group learning on campus [20] and in online breakout rooms [17].

Table 1. Detailed agenda for the digital 3-h seminar on Zoom, Oslo Metropolitan University, 18 August 2021 [A].

Time	Fixed Time Schedule That All Nursing Students Should Follow
08:30	Main Zoom room (host and co-host): Begin session 1. Welcome and introduction to the topic and background, along with presentation of scenario-based learning paths embedded in ThingLink. 2. Using Zoom's screen share feature to show digital tools, create breakout rooms and randomly assign four students to each room (host).
08:45	Zoom breakout rooms: Working with fictive cases "Leif" and "Sarah" at first meeting with a nurse. [B] Tasks to be solved by the students in the breakout rooms: 1. Select a group leader (NN) who makes sure that this fixed schedule is adhered to. 2. Evaluate if the health record documentation is adequate for the fictive cases at first meeting. 3. Discuss ways that adequate health records have an impact on patient safety. 4. Screen the two fictive cases ("Leif" and "Sarah") using MNA-SF.[C] Send [D] your individual screening scores into the Mentimeter word clouds. 5. Discuss the spread in the Mentimeter word clouds and whether the interindividual variation between students may also occur in clinical practice. 6. Which of the following diets should be the diets for the fictive cases ("Leif" and "Sarah")? (1) A health-care standard diet; (2) an extra energy-dense diet; (3) or a gelation diet? [E]
09:45	Break (NB. Do not log out of your breakout room. If you do, you will be randomly assigned into a new breakout room.)
10:00	Zoom breakout rooms: Scenario-based learning paths for the two fictive cases ("Leif" and "Sarah") after six months of clinical follow-up. [B] 1. Negative patient outcome: Click on the hotspots for both "Leif" and "Sarah" and read the documentation in the health records. 2. Discuss: If you were a recently graduated nurse candidate, how would you like to take over responsibility for "Leif" and "Sarah" based on these health records? Which of these two health records are in your opinion the most adequate, and why? 3. Positive patient outcome: Click on the hotspots for both "Leif" and "Sarah" and read the documentation in the health records. Discuss: Why are the diet choices for "Leif" and "Sarah" good dietary choices? 4. Screen both "Leif" and "Sarah" (negative and positive outcome) using SF-MNA3 and send4 your scores into Mentimeter word clouds. 5. See the finished word clouds (positive and negative outcome for both cases). Discuss the spread in the word clouds and whether the interindividual variation between students may also occur in practice. 6. Is the interindividual variation in the word clouds higher after six-month follow-up than the interindividual variation in the word clouds at start-up? How may a large interindividual variation in screening scores affect patient safety? 7. Discuss: Would you get a different result if you had used another malnutrition screening tool, such as nutritional screening tool NRS-2002? (Students return from Zoom breakout rooms):
11:00	Main Zoom room (host and co-host): Summing up and questions
11:30	Evaluation: Link to questionnaire embedded in LMS Canvas

[A] This exact time schedule for the Zoom seminar was shown in the Canvas learning management system (LMS) so that the student groups could work independently in the breakout rooms. The students were expected to work with the content in Canvas (academic content and digital tools) while simultaneously participating in Zoom breakout rooms. [B] One male ("Leif") and one female ("Sarah") were provided as cases, albeit with no reference to color of hair and skin. Scenario-based learning paths were embedded into the ThingLink platform using simple drawings. Students clicked on icons/hotspots beside each drawing, which provided access to medical documentation from the fictive electronic health records. Different scenarios were created for the students in which different malnutrition-related challenges at first meeting with a nurse and after six months follow-up were included. Both positive (e.g., leaving the hospital for home care and rehabilitation) and negative (e.g., complications and dying) were included in the case scenarios. The storyline evolves based on the nutritional choices made by the students. [C] SF-MNA = Mini Nutritional Assessment—Short Form. [D] Mentimeter word clouds: students could use their mobile phone [E] The Norwegian diet handbook [21] based on European guidelines [4].

All academic learning material was embedded in Canvas, a learning and management system (LMS). The learning material was based on a Norwegian patient safety program targeting the prevention and treatment of malnourishment (hospital wards, nursing homes and home care services) [22], the Norwegian national guidelines for prevention and treat-

ment of malnutrition and previous research [9,23–26]. Students were encouraged to prepare themselves before they met with peers in breakout groups to achieve a higher prerequisite for their clinical studies and a higher learning outcome from the work in the breakout rooms.

Older adults male ("Leif") and female ("Sarah") personas were created with fictive health record information and no reference to color of hair and skin. They were presented to the students using simple drawings on the ThingLink platform. Both cases had different malnutrition-related challenges at admittance to health care (ThingLink 1) and after a six-month follow-up (ThingLink 2). Both positive (such as leaving the hospital for home care and rehabilitation) and negative (such as complications and death) outcomes were included in the scenarios. The storyline evolved based on the nutritional choices made by the students, and relevant dietetic information [4,21] was provided on ThingLink. In this way, the students could practice solving different challenges safely in a digital environment. They clicked on icons/hotspots beside each drawing that provided access to fictive electronic health record documentation. The quality of the health documentation was for pedagogical purposes, and it did not carry standard-equaling high-quality care and good nutritional practice (i.e., it was clinically inadequate). The students screened the fictive cases through the Mini Nutritional Assessment (MNA) tool web application [27]. Hotspots on the fictive cases contained links to the web application, and detailed instructions were provided on ThingLinks for filling out the MNA tool for obtaining a malnutritional risk score. A score of 12 or greater indicated that the person is well-nourished and needed no further intervention. A score of 8–11 indicated that the person was at risk of malnutrition. A score of 7 or less indicated that the person was malnourished. The learning unit had no formative or summative assignment, but the students had to send their individual MNA screening scores to Multimeter Word clouds. The spreads gave the students a visualization of the interindividual range in terms of MNA scores. These clouds, which were shown during the seminar, showed an unacceptable spread of frequency of screening scores for the fictive cases, ranging from well-nourished to at risk of malnutrition and malnourished (data not shown). The spread was to be discussed in the breakout rooms (Table 1). The seminar was based on students solving realistic case-based tasks in the breakout rooms that were designed to challenge the students to question their own knowledge and motivate them to seek new understanding of good nutritional practice and patient safety. They could click on hotspots for relevant information, such as for details on different hospital diets. This was a student-centered form of teaching that focused on students' individual learning needs. The idea was to build knowledge for the future, and the immediate purpose was to create engagement among the students.

During the seminar, the students were asked to work alone in breakout rooms based on a fixed, self-administered time schedule (Table 1). The host created breakout rooms after a plenary outline (15 min explaining the schedule and technical issues and answering questions from the students) and before randomly assigning students to each room (4 students per room). The educators (*n* = 2) did not visit the breakout rooms during the seminar, but the students could "raise their hands" when they had a question. The students were instructed not to log into Zoom using their private emails to avoid technical issues. At the end, the host provided a short summing up.

2.3. Pilot Study and User Involvement

During May 2021, third-year nursing students (*n* = 24) participated in a pilot delivery, and feedback on the learning outcome and overall delivery was received through electronic questionnaires. On a scale of 0–5, only one out of 24 students (4.2%) disagreed (score 0/1) that the fictive digital cases were realistic. Only two out of 24 students (8%) did not understand the scenario-based learning paths after six months. Prior to this pilot delivery, the educators had involved students in the development of the learning unit. A third-year bachelor student of public health nutrition, who was involved as part of her practicum period, pilot-tested the draft on her own course peers and on two second-year nursing students during March 2021.

Only minor revisions were made after the pilots (less digital learning material to read ahead of the seminar, and fewer tasks to be discussed during the seminar).

2.4. Online Evaluation Survey

At the end of the seminar, the students were invited to participate in an anonymous online survey. No previously validated questionnaire targeting our purpose was available in Norwegian; thus, the present survey questions were specially prepared. Drafts were discussed among colleges (academic and administrative) and accordingly revised. The questionnaire was based on earlier research using the "Nettskjema" anonymous, self-administrated web survey [28], prior research [17,20] and the pilot study (*n* = 24). Nettskjema is a tool for designing and conducting online surveys with customized features for research. It is easy to use, and respondents can submit answers from a browser on a computer, mobile phone or tablet. The questionnaires, which consisted of both open and closed questions, were tested among the pilots and revised accordingly. The closed questions were scored on a scale from 0 ("completely disagree") to 5 ("completely agree"). Closed questions with predefined alternatives were selected to ensure comparability, simplicity and neutral non-leading language. The students were also asked to elaborate on their answers about recording in an open question. The questionnaire was provided as an internet link embedded in LMS Canvas. One reminder was sent.

2.5. Data Analysis

Quantitative data, which were extracted directly from the survey system, were described with numbers and percentages. The share of students "strongly/completely agreeing" (score 4/5) and "strongly/completely disagreeing" (score 1/0) on various items of the questionnaire was presented. The open-ended responses were analyzed by NVIVO software using the auto codes, stop words, word clouds, text search and word tree functions. Manual coding was also applied to assess thematic saturation. Only rich quotes relevant to the present aim were selected, whereas the rest of the responses were paraphrased.

2.6. Ethics

The Ethical Guidelines for Research at Oslo Metropolitan University (OsloMet) were followed [29], and the study had been approved by the Head of the Nursing study program. The Norwegian Centre for Research Data (NCRD) is a public organization that ensures the protection of personal data [30] and compliance with general goals of digitalization, data sharing and open research. The NCRD stated that we were not obligated to report the study to them since it was anonymous and no sociodemographic information was collected. None of the participants were under 18 years of age. Due to the low number of male and older age students, we did not ask for gender and age. The participants were provided written information about the study in the LMS Canvas prior to the start. The voluntariness and anonymity of the participants were emphasized, and the participants were informed of the purpose of the study and how the data would be used. Answering the questionnaire was considered informed consent to participate. The students could withdraw at any time by not logging into or logging out of Nettskjema before answering the questionnaire without any consequences for them as students. The study complies with the Declaration of Helsinki.

3. Results
3.1. Closed Questions

The response rate was 25% (78/309; Table 2). A high learning outcome was reported for the use of digital cases among 40% of the students, and 67% agreed that the fictive cases were realistic. In contrast, only 10% and 3% disagreed with these statements, respectively.

Table 2. Distribution of responses [A] to statements after participation in a digital learning unit (N = 78; %).

	Scores:					
	0	**1**	**2**	**3**	**4**	**5**
My learning outcome from the fictive cases was high	3.8	6.4	14.1	35.9	16.7	23.1
The fictive cases and the scenario-based learning paths were realistic	1.3	1.3	12.8	16.7	34.6	32.1
It was easy to understand the health documentation at first meeting with nurse	1.3	12.8	21.8	32.1	19.2	14.1
It was easy to understand negative and positive health outcome after 6 months	5.1	10.3	20.5	26.9	16.7	17.9
It was easy to understand how choice of dietary measure may affect health outcome scenarios positively or negatively	1.3	11.5	12.8	29.5	14.1	30.8
It was easy to understand that low-quality health documentation in patient records may lead to low patient safety	0	0	7.7	7.7	25.6	59
It was easy to understand that nursing practice includes good nutritional practice	1.3	1.3	10.3	15.4	30.8	41
It was easy to understand nurses' legal responsibilities	1.3	3.8	15.4	23.1	14.1	41
My learning outcome was high from the digital seminar	5.1	16.7	14.1	29.5	15.4	20.5
The time securable was adequate	2.6	1.3	7.7	17.9	30.8	38.5
The group size was adequate	1.3	1.3	7.7	15.4	23.1	48.7
My learning outcome from quizzes was high	3.8	9.0	11.5	24.4	16.7	25.6
My learning outcome from word clouds was high	7.7	11.5	17.9	23.1	23.1	16.7
It was motivating to work in breakout rooms	12.8	11.5	11.5	21.8	20.5	20.5
I was academically prepared [B] ahead of the group work	34.6	12.8	14.1	11.5	10.3	16.7
My peers were academically prepared [B] ahead of the group work	23.1	11.5	11.5	25.6	12.8	15.4
I have previous experience with using a malnutrition screening tool	32.1	9.0	14.1	19.2	10.3	15.4
	Don't know		No		Yes	
Did you find the digital learning unit relevant to working life?	10.4		9.1		80.5	
Do you think that participation in the digital seminar day should be mandatory?	25.3		37.3		37.3	
Do you want a synchronous question time room with a clinical dietitian after you have started your clinical studies?	5.3		5.3		89.5	

[A] On a scale from 0 to 5, where score 0 means "completely disagree" and score 5 means "completely agree", state how much you agree or disagree with the following statements? (%) [B] I.e., had read through all the pages of the LMS module on malnutrition and performed the individual tasks before the groups met in breakout rooms.

Fewer than 20% disagreed that it was easy to understand the electronic health record documentation and drawings on ThingLink, both on admittance to health care and after six months' follow up. Only 13% disagreed that it was easy to understand how the choice of dietary measure may affect patient outcome.

The majority (75% and 72%, respectively) agreed that it was easy to understand how low-quality documentation would lead to low patient safety and that good nutritional practice was linked to the nursing process. Only 5% disagreed that it was easy to understand the nursing profession's legal responsibilities with respect to nutrition.

Among all students, 46% agreed that they had a high learning outcome from the digital seminar day, whereas 22% disagreed with this statement. Fewer than 20% of the students disagreed that the learning outcomes from the Mentimeter word clouds and quizzes were high.

Approximately two-thirds agreed that the group size of the breakout rooms was adequate. Less than half (41%) agreed that working in digital groups was motivating, whereas 24% disagreed. There was an even spread across the categories concerning the lack of preparation among themselves and their peers for the use of the digital learning material in LMS Canvas before the synchronous seminar.

Among all students, 81% agreed that the digital learning approach during the seminar was relevant to their own future practice, whereas 9% and 10% answered "No" or "Do not know", respectively. A total of 37% agreed that a digital seminar day should be made mandatory, whereas the same number disagreed. Nearly all of the students (90%) wanted a synchronous live session during which they could ask questions to a clinical dietitian while they were in clinical training. In total, 41% (score 0/1) of the students had not screened a patient for nutritional status before the digital seminar, whereas 26% (score 4/5) had used a screening tool.

3.2. Open Questions

The open questions resulted in the following main responses:

3.2.1. Experiences with the Digital Patients and Digital Response Systems

Students were positive towards the case-based learning approach. The scenario-based learning paths embedded into the ThingLink platform after six months' follow-up were less understandable than those at admittance to health care. Only one student commented negatively on the use of homemade drawings to illustrate the cases. The low-quality documentation of the health records was directly and indirectly commented on by several students. One student recounted:

> *"Give more explanation of patients' scenarios after six months. The documentation on measures and dietary follow up was incomplete. It was difficult to understand."*

Several students expressed that they understood the spread of MNA scores in the word clouds to be a proxy measure of the interindividual differences in MNA scoring, and that a huge variation between individuals would be a threat to the patient safety. One student said:

> *"It was useful for comparing what other students had answered and for realizing that a lot of misunderstandings can arise both in the classroom and during practice."*

3.2.2. Experiences with the Pedagogic Approach of the Digital Learning Unit

Overall, the students reported that they were satisfied with the size of their group. The major challenges in the breakout rooms involved students who were passive, unprepared or who did not turn on their camera or contribute to the discussion. Moreover, some students logged into the breakout room too late or logged out too early; thus, not only did the group size change during the digital group work, but the group work progress was interrupted. Several students expressed that they preferred to work with someone they already knew. One student recalled:

> *"We were four students in the group, but only two of us spoke. We tried to include all of us, but we got limited response from the two others. Another student entered the group at the end. It was very nice that there were four of us, so we could screen one patient each when it comes to positive/negative for Leif and positive/negative for Sarah."*

Several students reported that the information on the pedagogical approach was inadequate, and that they would have preferred a structure with a longer synchronous plenary lecture at the beginning of the seminar day and further close follow-ups by educators/supervisors during the seminar. Comments were also made on time schedule management: it was either too much time, or the groups did not really use the available time to discuss the tasks. Some students commented that they would have preferred physical attendance at their own campus:

"I wish we had talked more about how we had thought differently among the different groups. That is, all the groups could have told more about what they had discussed together at the end, to understand the rationale for such different answers."

3.2.3. Academic Content and Relevance in Working Life

The students expressed that the working life relevance of the seminar was high. One student was critical to the choice of "worse-case scenarios" and suggested that these include more "normal-case scenarios". Several students expressed a need for there to be increased focus on nutrition in nursing education. Some expressed that the learning unit would have benefitted from having less focus on poor documentation in records and greater focus on nutrition, hospital diets and malnutrition.

4. Discussion

This is the first study to explore digital CBL learning for prevention and treatment of malnutrition in nursing education. The study supports implementing prevention and treatment of malnutrition in the nursing curriculum. Concerning the pedagogical approach, the students gave valuable and constructive feedback that will be discussed further.

4.1. Students Need Training in Good Nutritional Practice on Malnutrition

Nearly all students agreed that the digital learning unit during the seminar was relevant to their own professional future practice. They agreed that it was easy to understand how the choice of dietary measure may affect patient outcome, how low-quality documentation would lead to low patient safety and that it was easy to understand the nursing profession's legal responsibilities with respect to nutrition. However, from a clinical perspective, the interindividual spread of frequency of malnutrition MNA screening scores that appeared in the word clouds during work in breakout rooms was unacceptable with respect to patient safety. From a pedagogical perspective, this learning approach may have raised students' awareness towards nurses' responsibilities with respect to entering valid patient data on nutrition into patient health records. Clearly, we had hoped that the learning unit had resulted in a more uniform scoring and that they were able to screen the fictive cases correctly. Since learning engagement is strongly influenced by prior knowledge [31], this finding most probably reflects the lack of nutritional content in nursing curricula [8]. Some students might have worked as nurse assistants with patients diagnosed with malnutrition. This would fit with the result that some of these students reported to have previous clinical experience with using a screening tool. Thus, their preparedness before entering the learning unit might have been unequal. One study reported that students who most needed help because they had low prior knowledge were less likely to seek help or engage in executive help-seeking [31]. That study showed that different levels of prior knowledge resulted in different outcomes with less structured help but the same outcome with well-structured help [31]. Thus, the responses to the present design with minimal interaction with the educators might be taken as support for the very important role of educators in digital pedagogy, and in particular when baseline knowledge is low or lacking [32]. Nevertheless, these data support implementing prevention and treatment of malnutrition in the nursing curriculum [8,33]. However, there is a need to work further to develop learning units for nursing students within clinical assessment of nutritional status and good nutritional practice.

4.2. The Pedagogical Approach

The development and first-time delivery of this learning unit went well from a technical point of view. However, the students expressed that they wanted more "traditional" synchronous interaction with educators and less time spent in breakout rooms. They wanted a more thorough plenary session at the end of the seminar in which the group work and overall implications for nutritional practice would be summed up. Nearly all students wanted a live-streamed synchronous session with a clinical dietitian during which they

could ask questions. Less than half of the students agreed that it was motivating to work in breakout rooms.

Although active learning promotes student learning, educators are reluctant to change their approach to teaching for various reasons, including a fear of student resistance to active learning [15]. The dominant barrier is pedagogical assumptions among educators [15], which might manifest in a culture leading to a reluctance to adopt technologies and digital education [12]. Barriers to digital tools and distance education are related to educators having limited experience, knowledge of using digital tools and even a fear that digital education may reduce or remove traditional activities on campus [12]. Although modern technology provides new opportunities to activate students, educators have mainly been delivering traditional teacher-based plenary lectures using screen sharing during COVID-19 pandemic lockdowns [34–36]. The challenge of such a pedagogy is the lack of active student interaction. Thus, even after over a year of digital education due to the pandemic, these students might have little prior experience with digital student-active methods and more advanced digital tools.

The same challenges as for in-person group work on campus were found for group work in breakout rooms, namely unprepared peers, peers showing up too late, peers not contributing to the group process and peers withdrawing after breakout room sessions had started. Some students may not able to dynamically participate in group work, for personal or technical reasons, whereas other students might dominate [17]. The percentage of students who did not prepare themselves before working together in the breakout rooms resembles the percentage who were previously observed from in-person interprofessional small groups of professional students [37,38].

Although students are often large private consumers of digital technology, they may not have sufficient digital skills to use digital tools in an educational setting [18]. Although two-thirds of the students responded that the fictive cases and health record documentation were realistic, only 40% of the students reported a high learning outcome from the ThingLink platform. The use of ThingLink in an educational way might have been a first-time experience for the students. The pedagogical added value of presenting the cases on ThingLink instead of in a text description in a word document might have been not only lower than the educators had anticipated but also a confusing approach to students. Thus, they may have used synchronous peer-to-peer learning time during the seminar to familiarize themselves individually with the ThingLink platform, which may have resulted in less time for effective group work targeting good nutritional practice. In contrast, the students reported a high learning outcome from quizzes, and word clouds, which is the more frequently used SRSs. Our results fit well with SRSs being pedagogical awareness-raising tools which may help students "make connections" from theory to practice [11].

The students wanted to be placed into Zoom breakout rooms with familiar peers. Similar findings have also been found in other studies [36,39]. In their mandatory nursing subjects, they were divided into fixed student groups as a pedagogical approach, as fixed groups may help students to develop working relationships with fellow peers and learn skills that they can use when working in teams in health care [36]. In one study, most of the students who had negative experiences with breakout rooms just wanted to be placed in a different room with students who actually participated [40]. These data support that educators should take responsibility for group formation rather than leaving it to chance, especially for member selection, group composition and group [40,41] size [40].

A group size of four would in theory give all students the opportunity to speak in and contribute to group discussions. However, as expressed by the students, the group work quality was not dependent upon the exact number of people but on how well the students were prepared, collaborated and contributed. To avoid having black screens, all students were initially instructed to use university email so that they had the option to turn on a virtual background in case they wanted some privacy in their home office. However, the students expressed that some of them did not turn on their cameras. Technically, it is possible to exclude students who log on too late, mute/unmute them, preassign them

according to academical level and other variables [40]. Social introductions may help to create a safe space when later requesting that students engage in self-administrated activities [42], and, in retrospect, we might have underestimated the need for social introduction in the breakout rooms.

Some students expressed that they had missed some of the groups presenting their proposed answers in the main Zoom room after the breakout discussions had finished. In this way, all students would have been given an opportunity to provide input, ask questions or propose an alternative solution in plenum [36]. At the end, the educators could have expanded the students' explanations, as needed. The main reason for not including peer-to-peer reviews in the main Zoom room was that this seminar was voluntary and time-limited. Although our university offers a digital peer-to-peer evaluation tool, Feedback Fruits, we did not want to jeopardize this first-time delivery by adding additional complicating technology. The peer-to-peer learning was therefore restricted to the breakout rooms and based on only oral communication and collaboration. Low-quality peer-to-peer learning in their own breakout rooms may explain why the students also wanted peer-to-peer learning in the main Zoom room.

In retrospect, we may have underestimated the students' need for supervision in the breakout rooms. Instead of having educators rotate through breakout rooms to visit the groups, we seized the opportunity to explore the students' opinions of using a design with minimal interaction with the educators. Some students expressed that they would have preferred help from an educator in the breakout room. Although they had the opportunity to raise their digital hand for help, they might have been too shy to actively ask for it from educators. Group dynamics are fundamental for learning outcomes in group work [35], and these students might not have been adequately trained on group processes or those involving persons they did not previously know. A scoping review on learning outcomes from digital learning interventions [32] has suggested that the role of teachers and supervisors is even stronger in distant education. Strong and weak students may react differently to active learning, possibly due to lower attendance and interaction among the weak students [43,44]. Interestingly, educators involved in student active learning methods in breakout rooms are called instructors, teachers, supervisors, moderators and facilitators [35,36,45]. This inconsistency in terminology might reflect the fact that digital pedagogy is still in transition [12].

4.3. Strengths and Limitations

Causal relations cannot be established with a cross-sectional approach, and the study is therefore explorative. Because of this, we had not planned data collection to test the hypotheses. Data were collected during an evolving iterative situation from home offices; nevertheless, even with some limiting factors, we believe the explorative study offers value since it provides a student perspective during long-lasting lockdowns due to the COVID-19 pandemic. To the best of our knowledge, no suitable questionnaire for the present purpose has yet been translated and validated in the Norwegian context. The low response rate is at the same level as the response rate in studies performed in a pre-COVID-19 situation. Though the relatively low response rate, which is in line with a declining response rate for surveys in general, might threaten the validity and generalizability of the results, a high response rate does not guarantee sample quality. Finding that only 41% of the students agreed that digital groups were motivating is an innate limitation of this study. During Covid, when most pedagogical approaches were changed over to digital forms to reduce social contact, it is understandable that lack of social contact led to general lack of motivation and passivation among students. Further research on approaches and alternative ways to activate students in digital groups seems vital to find the optimal balance and level of digital vs. physical education approaches.

The data are based on self-reported engagement, and self-selection bias may not be excluded. Major study strengths include anonymous data collection, a mixed methods approach (open and closed questions) and a research team consisting of both nurses and

clinical dietitians. OsloMet is one of Norway's largest universities and home to the largest nursing education class in Norway. As professional curricula content is regulated by the Norwegian government, this study can be applied to other types of education in Norway. Moreover, since malnutrition is not an isolated Norwegian phenomenon, the findings could also be of interest to educators outside Norway.

5. Conclusions

To conclude, the academic content in this learning unit received more positive feedback than the pedagogical approach. The students wanted more synchronous time with educators and less time in breakout rooms due to peers being unprepared, passive or unfamiliar. The reported challenges with student active learning methods in the breakout rooms resemble the challenges reported for face-to-face student active learning methods on campus. The study lends strong support to the fact that prevention and treatment of malnutrition should be implemented in nurse education curricula. We suggest a multi-professional approach, using new technology, such as Massively Multiplayer Online Role-Playing Games (MMORPG), in student active learning design. However, there is a need to work further to develop learning units for nursing students within a clinical assessment of nutritional status and good nutritional practice.

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