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Modification of national OSCE due to COVID-19 – implementation and students' feedback

Running title: Experience on modified online OSCE during COVID-19

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Modification of national OSCE due to COVID-19 – implementation and student feedback

Abstract

The aims were to describe the development of a modified national online OSCE during COVID-19 and assess related student feedback.

Material and methods: The modified online OSCE comprising of eight question entities was organized simultaneously in all four dental institutes of Finland using the Moodle virtual learning environment. All fourth-year students (n=179) attended the exam online at home. Student feedback was collected via an anonymous questionnaire with multiple-choice questions and open-ended questions concerning attitudes towards the modified online OSCE, as well as content and usability of the question entities in the exam. Means and standard deviations were calculated for multiple-choice questions. Content analysis was used for open-ended questions.

Results: Of 179 students, 119 (66%) consented to the study. Students experienced they had received adequate information (mean 3.8; SD 1.2), had a positive attitude before the exam (4.0; 1.0) and found the practice test useful (3.7; 1.1) (range 1-5). Technical implementation (2.7; 0.7) and the difficulty of the questions (2.9; 0.6) (range 1-4) were found to be good. The teaching students received during their studies was sufficient (3.2; 0.5) (range 1-4). Content (mean 3.2; 0.4) and usability (2.9; 0.4) of the question entities were good (range 1-4). The themes arising from open-ended questions were importance and practicality of the topic (in questions) in relation to the work of a dentist and gratitude for the rapid conversion of the OSCE into an online exam despite Covid-19. The themes arising from negative experiences included difficulties in completing the exam within the time allocated, and dissatisfaction with the model answers provided after the exam.

Conclusion: The positive student feedback towards the modified online OSCE encourages including an online exam to complement the traditional OSCE.

Key words: OSCE, assessment, online learning

Introduction

The Objective Structured Clinical Examination (OSCE) is a valid, reliable and reproducible assessment method that tests clinical competencies objectively in a structured way and it is widely used in undergraduate dental education.¹⁻⁴ In Finland, all four universities that provide undergraduate dental education have organised a national simultaneous and completely identical OSCE for several years as part of fourth year curriculum. The OSCE assesses the nationally agreed standard clinical competences based on ADEE competencies⁵ and has been evaluated systematically.⁶ Passing all the studies during first four years, including OSCE, is required for undergraduate dental students in Finland to obtain the rights to temporarily pursue the activities of a licenced professional under supervision either in public or private oral health services outside the dental school.⁷ The universities are required to guarantee the knowledge and the level of clinical skills, and OSCE is vital part of this assessment. Based on the statements of the universities, the rights are authorized by the National Supervisory Authority for Welfare and Health (Valvira) in Finland.

Due to the COVID-19 (coronavirus disease 2019) pandemic, restrictions in contact teaching and examinations began in March 2020, including the OSCE scheduled on 23 April 2020. As completion of the OSCE is required to fulfil the criteria set in the universities' curricula as well as for the right authorized by Valvira's (successful completion of all courses included in the first four years of curriculum), there was an urgent need to organize a modified OSCE as an online exam. It has been reported that European academic dental institutions have made modifications to the delivery of education and clinical care during the COVID-19 pandemic in order to protect patients, students and staff, but at the same time to sustain students' continued academic progress.⁽⁹⁾ Most schools have also considered postponing the evaluation of required clinical competences or changing the assessment schedule, but not to reduce the clinical requirements.⁽⁹⁾ In general, the institutions had delayed assessments or organized examinations online.

In Finland, however, dental schools considered it important to organize a modified online OSCE not only to sustain students' continued academic process, but also to ensure a sufficient workforce. Delay in completion of fourth year studies would have resulted to shortage of over 160 authorized dental students in providing oral health services that were severely affected by COVID-19.

The aims of this study were to describe the development and implementation of a modified national online OSCE during COVID-19 and to report the student feedback on it.

Materials and methods

The modified online OSCE was organized simultaneously in all dental institutes (Universities of Eastern Finland, Helsinki, Oulu and Turku) in April 2020 according to the original schedule using the Moodle virtual learning environment. All fourth-year pre-graduate dental students (n=43 in Eastern Finland, n=43 in Helsinki, n=51 in Oulu, n=42 in Turku, total n=179) attended the exam. Students had an open possibility to complete a practice test online at home which included similar question types (multiple choice question, drag and drop onto image and essay) as the actual exam.

Due to the tight timeframe, the national coordinating team chose and modified all question entities to be applicable in an online exam from assignments and assessment criteria previously used in OSCEs. The questions and the assessment criteria were subjected to peer evaluation by responsible teachers within disciplines in all dental institutes.

The modified online OSCE had eight question entities, each including 1-6 questions. The question entities and their assessment are described in Table 1. Students were scheduled to have 80 minutes to complete the exam with the average time of 10 minutes for each question within a 90-minute timeframe including shifts between questions. For students with dyslexia diagnoses, 10 extra minutes was included individually in the settings of the online exam in Moodle. Students had one attempt to pass the exam and the questions had to be answered one by one in the given order similar for all the students without the option to return to the previous question.

The assessment criteria were determined as a checklist containing pre-determined items. No feedback was given during the Moodle exam, but students were allowed to see the assessment criteria immediately after the exam. The pass rate in the question entities ranged from 50 to 70%. The teachers responsible for the clinical discipline related to specific OSCE question entities assessed the exam questions using strict assessment criteria. Grades were inserted manually for those questions where automatic grading in Moodle was not used. The final grades were given to the students one week later, when the national evaluation of the results had been completed. Students had to pass all eight entities in order to pass the modified online OSCE. Students who

failed a discipline entity had to re-perform it in a re-take of the online exam in Moodle two weeks after the OSCE.

One day after the modified online OSCE, the students were asked to fill in an anonymous electronic questionnaire with multiple-choice questions and open-ended questions. They were provided with written information about the details of the study and were asked to provide online consent to use their replies in this study. Three questions inquired about the experiences before the exam using five-point Likert scale (1=fully disagree, 5=fully agree) for the following statements: 1) I received adequate information about the exam, 2) I had a positive attitude towards the exam and 3) The practice test was useful. Then, the students assessed the modified online OSCE with four-point Likert scale for its 1) technical implementation and 2) difficulty of the questions (1=poor, 4=excellent), as well as 3) if the teaching they have received during their studies has been sufficient in relation to the modified online OSCE (1=completely insufficient, 4=completely sufficient). In addition, two open-ended questions inquired about the positive and negative attitudes the students had towards the modified online OSCE before the exam.

The students were asked to assess each question entity for its 1) usefulness, 2) interest, 3) technical implementation and 4) appropriateness of the time allocated. In addition, open-ended questions inquired about their positive and negative experiences regarding each question entity, ideas for further development of Moodle online exams and a possibility to provide any additional comments.

Responses to the multiple-choice questions are described using means and standard deviations. In addition, individual sum scores of the usefulness, interest, technical implementation and appropriate time allocation were calculated for all question entities. Further, the sum scores (mean, SD) of the usefulness and interest was described as 'content' for each question entity and all question entities. Respectively, the sum score (mean, SD) of the technical implementation and time allocated was described as 'usability' for each question entity and all question entities. Statistical significances between the means of 'content' and 'usability' were calculated by Wilcoxon signed rank test. Data were processed with IBM SPSS Statistics (version 25) statistical software.

The responses to the open-ended questions were analysed with content analysis by reducing original expressions and grouping the content based on similar expression categories.⁸ (Table 2) Three authors (HH, TT and TK-S) read the open-ended responses independently. HH and TT then

discussed the themes that had arisen. TK-S constructed independently the themes which were further discussed among the three authors.

Results

Of 179 students participating in the modified OSCE, 126 responded to the questionnaire and 119 (66%) consented to the study. The response rates according to universities were 61% in Eastern Finland, 74% in Helsinki, 75% in Oulu and 55% in Turku.

Students experienced that they had received adequate information, had a positive attitude before the exam and found the practise test useful (Table 3). The technical implementation and the difficulty of the questions in the overall OSCE were found to be good. Students experienced that the teaching they had received during their studies in relation to the modified OCSE was sufficient.

Students' assessments of the usefulness, interest, technical implementation and appropriate allocation of time for question entities are presented in Table 4. The mean value of all variables of the question entities including individual score sums was good (mean 3.0; SD 0.4). The mean of the sum scores of 'Content' (3.2; 0.4) was slightly higher than that of 'Usability' (2.9; 0.4), but both were good.

In question entities, the content was assessed to be higher than the usability, except in 'Cross infection control', where the usability of the question entity was higher than the content.

Responses to open-ended questions

The themes arising from the positive opinions before the online OSCE were the possibility to attend the exam despite COVID-19, a well-functioning online environment, the online exam being less stressful than a live exam, and the possibility to do the exam at home.

It is good that the exam was organized despite the exceptional circumstances.

I found it good that in this exceptional situation the Institutes reacted on a quick schedule.

In Moodle, doing an OSCE felt less stressful and it seemed easier to express your competence. The remote exam wasn't as stressful as if someone had observed me in a live situation.

The themes arising from the negative opinions before the online OSCE were worries about technical problems in the online environment, doubts about whether the exam can test clinical

competencies similar to the traditional OSCE, and whether the level of difficulty of the online exam is different from a live OSCE.

I was worried that technology would fail during the online exam.

I wondered how an exam usually measuring practical skills could be adapted to a Moodle exam.

I was afraid that the online exam would be much more difficult than the traditional OSCE.

I was worried about the effect of the online format on the content of the OSCE.

When analysing the positive and negative opinions concerning the question entities, students' experiences were found to be rather similar for all question entities. However, clearly more positive than negative open comments were submitted. The themes arising from the positive experiences of the online OSCE were the importance and the practicality of the question topic in relation to the work of a dentist. In a few responses, the current Covid-19 pandemic situation was especially mentioned.

Very important core competency issues for all healthcare staff.

Important topics that every dentist should be able to manage in their practice.

Important subjects both during and after the [Covid-19] pandemic situation.

The clarity and the quality of the questions/assignments and the pictures related to the assignments were raised both as a positive and negative theme. The assignments involving patient cases were considered good.

The assignment was good (for example, pictures).

The task was clear.

The assignment was a bit confusing.

The layout of the question was not good and it could be easily misunderstood.

It was nice that the multiple-choice question was based on a clinical case.

The themes arising from the negative experiences of the online OSCE were difficulties in completing the exam within the time allocated and dissatisfaction with the model answers (assessment criteria) provided after the exam.

The feeling of having too little time overshadowed the whole exam.

The model answer does not correspond to the assignment.

Ten minutes was not enough time to produce a response to level of the model response.

Themes arising from the ideas for developing this kind of online exam were revisions of the questions and assignments and more detailed information beforehand.

How the question entities are distributed should be clearer [within the timeframe].

Clearer assignments for the questions!

Themes arising from the additional open comments were gratitude for the rapid conversion of the OSCE into an online exam and need for more accurate information before the exam. The students also wished for more clarity of the structure and timetable for the exam.

Thank you very much for organizing the OSCE online in such an exceptional situation and on a short schedule.

The students also suggested that this type of national exam could be useful also as an additional assessment combined with a traditional national OSCE.

Practical skills could be tested in a traditional live OSCE and additionally there could be a national online exam for testing theoretical knowledge.

This kind of online exam model could function well in the future as a re-examination.

Discussion

The implementation of the modified online OSCE was in general found to be successful by the students. The technical implementation of the online exam and difficulty, as well as content and usability of the question entities, was found to be at a good level. Students had on average a positive attitude towards the online exam beforehand and they felt that they received adequate information concerning the exam. According to the feedback received, patient cases and the clarity of assignments were considered positive. Technical issues and time management were considered as sources of stress. Overall, students appreciated the possibility to take part in the OSCE, even though it was online, in the exceptional circumstances during the Covid-19 pandemic.

In the modified online OSCE, students could not be assessed on the “show how” but only on the “know how” level as suggested by Miller.¹⁰ Nonetheless, all four major domains of ADEE competencies could be covered in most parts. The weakness of an online OSCE is that it cannot assess some aspects of clinical competencies, such as interaction and dexterity. We had to be content regarding the fact that we could not fully execute the blueprint and fulfil all the competencies in ADEE-based national learning objectives, for example professional behaviour (Domain I) and communication (Domain II).⁵ The strength of this study was a large study sample and satisfactory response rate. Also, the feedback survey was completed shortly after the exam reducing the recall bias in the replies. On the other hand, the replies to the open-ended questions

were relatively short, which might have affected the content analysis leaving more room for the researchers' interpretations researcher's interpretation.

OSCE as a learning situation

In the present study, existing nationwide learning objectives and core knowledge based on ADEE competencies⁵ helped to build the assessment criteria for the national online OSCE. Due to the tight timeframe, the assignments/question entities were chosen and modified by the coordinating team responsible for the national online OSCE from questions previously used in OSCEs. The clinical tasks were modified to be problem-solving questions related to the clinical work to provide clinical application scenarios which are of relevance in clinical practice. Students were supposed to combine theory and practice, not just memorized details. Students both acknowledged and criticized the assignments, but on the other hand they reported that the assessment was closely related to the work of a dentist and the teaching they received during their studies was sufficient in relation to the topics covered in the online OSCE. Assessment has a major role in students' learning, and the students choose the learning strategies based on learning outcomes and assignments to pass the course or the exam.¹¹ The aim or purpose of the assessment should also be clear for both students and teachers.¹² According to the constructive alignment,¹² assessment should be aligned with learning outcomes and teaching/learning activities.¹¹ In addition, assessment supports students in active learning and giving feedback on their learning.¹¹ They also received model answers immediately after the exam and received also general feedback, which is an additional learning possibility.

Näpänkangas et al.¹³ evaluated the correlation between the results of the OSCE and clinical assessment and concluded that both the OSCE and constant longitudinal assessment are needed, as they both play an important role in the overall clinical assessment. During the COVID-19 circumstances, combining constant clinical assessment with the results of the online OSCE was even more important than under normal circumstances. On this basis, all dental institutes considered that organizing the modified online OSCE was needed to guarantee the sufficient competencies of the undergraduate dental students for the statement of universities for Valvira's right to temporarily pursue the activities of a licenced professional under supervision.

Stress

Although dental undergraduate students reported having positive perceptions of OSCEs in general¹⁴, the OSCE has been shown to be a more stressful situation for the students than written exams.¹⁵ In this study, the OSCE was compulsory for the students to complete the fourth year of dental undergraduate studies and to gain permission to work as a dentist under supervision outside the dental school, which may have created extra stress. The OSCE-type exam is often a new experience for the students, in addition to that the assessment is performed during a live situation. They also had doubt beforehand regarding whether the exam can test clinical competencies as intensively as the traditional OSCE or whether the difficulty level of the online OSCE differed from the traditional one. However, the students experienced that it may be easier to express their competence online than in the traditional OSCE.

Before this modified online OSCE, the students worried about the technical problems in the online environment. The concern of technical issues related to online exams has been reported also earlier¹⁶, and in our case, the technical issues were consciously taken into account beforehand and the uniform settings for the online exam in the Moodle environment were edited nationally with the universities' IT support personnel. In addition, the information concerning the preferred browser and usage of a computer instead of a tablet or phone in the exam was given before the exam. The phone number of the contact person was also available during the exam. Based on the results, most of the students agreed that they received adequate information before the exam.

Online exam

Despite the technical problems, students' positive impressions related to e-assessment has been reported.¹⁶ An online exam gives possibilities to combine several kinds of assignments and question types to achieve a variety of assessments. Online exams also offer advantages in assessment such as automatic assessment and question banks. Among question types, multiple-choice questions can determine a student's ability to recall information and principles but may not assess higher levels of thinking.¹⁷ Also in the OSCE, modification with multiple-choice questions for assessing clinical competencies has been shown to be preferred to the written examinations in assessment by both students and examiners.⁶ Thus, combining multiple methods in assessment of knowledge and clinical skills, whilst simultaneously taking into account the feasibility and available resources, can provide more valid results.⁶

In the present study, students participated in the online exam independently at home and had access to the internet and other resources. This might have given them a chance to copy or chat with other students. However, the pass rate in this modified online OSCE was lower than in the traditional OSCE, suggesting that students did not use the copy or chat options widely.

Content and usability of the questions

Clarity and quality issues related to the questions / assignments, for example pictures used for the assignment, were raised both positively and negatively. Tasks involving patient cases were considered as good and students felt that the exam could include even more clinical patient cases or clinical pictures. In general, students experienced that questions measured core competencies of dental practitioners. Miller¹⁰ has challenged the education to reach higher levels than knowledge or skill, and with the well-designed online exam the application of theoretical knowledge to the patient cases can be achieved. Thus, according to Bloom's taxonomy, the level of application or analysis, rather than remembering or understanding, could be among the learning objectives also in the online exam.

Exam time management

Although most of the students felt that the timeframe for the entire modified online OSCE was appropriate, some students mentioned that they were in a hurry during the exam, but they had time left after the whole exam. According to the pre-determined settings, the eight question entities had to be answered one-by-one with no option to return to the previous questions within the 80 minutes. Related to this, the students were also confused about the information related to eight question entities beforehand, while actually having 16 questions marked in the online exam, because the question entity included more than one question.

In the online exam, the timeframe should be quite restrictive to complicate the use of extra material or "peer help" instead of testing the learning of the individual student. The commonly used OSCE station times for dentistry are 5 or 10 minutes.¹⁸ In our national traditional format OSCE we have used 10 minutes per station to be able to test several learning objects at one station. 10 minutes was thus chosen also for the virtual OSCE to represent our normal tradition. Obviously, the different kinds of questions (multiple-choice and drag-and-drop questions or essays) required different usage

of time. Thus, instead of having a specific time for the whole exam (in the present case 10 minutes for 8 questions, totalling 80 minutes), it would be better to have separate online exams for each question lasting 10 minutes.

Despite the fact that live OSCEs were arranged during the pandemic¹⁹, we could not perform a live OSCE as all of the universities were totally closed or teaching was strictly restricted. As we wanted to keep our OSCE national, a virtual format was our only option. On the other hand, successful implementation with positive student and teacher feedback on an online OSCE using clinical cases and oral examination has been reported²⁰. Should the pandemic continue, consideration of a locally arranged traditional OSCE with safety precautions is one option. Students worries about their clinical competences support this. Modifying the online OSCE, would be another option. The student feedback highlighted that in advance information on technical issues and time management are important to relieve students' stress with online exam. Even though clarity of the questions and model answers were mostly considered positively, there is need to consider the needs of different types of learners in order to ensure modified OSCE is a positive learning experience. Feedback on patient cases in assignments was very positive and these cases could also be used video recorded. Increasing the number of online question entities or including oral examinations are also options to improve the modified OSCE.

Conclusion

The student feedback provided useful information about their perception of the OSCE and it was well recognized and acknowledged that the modified online OSCE was not a clinical examination. Arranging the online OSCE promoted the progression of the dental students to get them permission to practice dentistry under supervision outside the dental school, and thus these students were an addition to the workforce needed during the Covid-19 pandemic. Based on the students' feedback, the modified online OSCE was created and arranged successfully despite the challenges related to the Covid-19 pandemic. The positive feedback towards the exam will encourage implementation of the national online exam alongside the national annual OSCE in the future.

Authors declare no conflict of interest.

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Table 1. Question entities described by Question/task topics, question/task descriptions and question/task types. Then, question/task assessment descriptions and pass rates and finally ADEE domain competencies tested in each question/task.

Topic of the question/task	Descriptions of the question/task	Type of question/task	Assessment	Pass rate	ADEE domains
General emergency	As a team leader, give instructions to the dental nurse in resuscitation.	essay	Procedures in resuscitation in correct order: talks to the patient (1p), shakes the patient (1p), lifts the chin and ensures the airway (1p), starts resuscitation within 20 seconds (2 p, mandatory), resuscitation follows 30/2 rhythm (1 p), correct pressure point (1p), correct pressure depth (1p), asks the assisting nurse to fetch the defibrillator (1p), advises the assisting nurse to insert the defibrillator pads (1p), continues resuscitation until medical assistance arrives (2 p mandatory)	Total 14 points, Passing rate 7/14 Mandatory points (4)	Professionalism Safe and effective clinical practice
Diagnostics of occlusion	Evaluate the orthodontic treatment need for 7-year-old children. Dental photographs of three cases were presented.	multiple-choice question and essay	1) right case of three cases presented (multiple-choice question) 2) in essay, the choice for question 1 was justified	1) right case chosen 2) correct justification	Patient-centred care
Referral	In the case of disfunction of the electronic form, write a free-form referral to specialist care using given patient health and diagnostic details. Produce the date, place and personal information freely.	essay	Needed: date and signature (0.5+0.5p), name and contact information of the dentist (1p), and patient (1p), special care target unit (1p), health, medication, alcohol and tobacco use of the patient (1p), case anamnesis and clinical diagnosis/reason for the referral (1p) and the level of urgency(1p)	Total 7 points Passing rate 5/7	Professionalism Safe and effective clinical practice Dentistry in society
Diagnostics of dental emergency	Your patient has swelling oedema in the lower molar region, see the case report and photograph. What is the diagnosis and what is your treatment plan?	essay	Diagnosis and periodontal treatment procedures: Diagnosis (2p), drainage of abscess (1p) (additional point if mentioning that it can be done either through gingival pocket or through gingiva), gentle biofilm removal with ultrasound or hand instruments (1p), rinsing of the gingiva pocket with endosyringe (1p), occlusion control (1p), evaluation of the need for antimicrobial medication (1-3 p depending on the reasoning), curettage of soft	Total 11 points Passing rate 6/11 Mandatory point	Safe and effective clinical practice Patient-centred care

			tissue (-1p), scheduling control visit (1p). Mandatory to know not to suggest endodontic treatment.		
Treatment alternatives for conservative care	Your patient has a fracture in the lower first molar, see the case report and photograph. Give three treatment options and produce reasoning for each option.	essay	1) Direct restoration (2 p) 2) Indirect restoration (2 p) 3) Single crown (2 p)	Total 6 points Passing rate 4/6	Safe and effective clinical practice Patient-centred care
Treatment-related tooth morphology	Select the correct location of endodontic access cavity preparations, six teeth presented in photographs (upper incisor, upper first premolar, upper first molar, lower incisor, lower second premolar, lower first molar) and the morphology alternatives as drawings.	drag and drop tooth numbers onto corresponding images for all 6 images	Correct endodontic access cavity preparation for each six teeth (1 point/tooth)	Total 6 points Passing rate 5/6	Safe and effective clinical practice Patient-centred care
Diagnostics and treatment of dental emergency	Your 3-year-old patient has an avulsion of a deciduous incisor. Ask the parents for the needed anamnestic data and give instructions for postoperative care.	multiple-choice question	Time and place of the avulsion (1.5 p), ensuring or scheduling valid vaccinations (1.5p), anamnesis (1.5 p), no replantation (1.5p), information concerning eating and tooth brushing (1.5+1.5p), effect of trauma to permanent teeth (1.5 p), follow-up by X-rays (1.5 p) Mandatory to know that replantation is not possible	Total 12 points Passing rate 9/12 Mandatory point	Safe and effective clinical practice Patient-centred care
Cross infection control	Select the correct order for personal cross-infection control procedures between patients.	drag and drop into text. three questions	Correct order in 1) hand washing (5 p), 2) hand disinfection (7 p) and 3) wearing protective gloves (3 p).	Passing rate 10/15	Professionalism Safe and effective clinical practice

Table 2. Content analysis method procedure used for open-ended questions analysis. Example of two questions.

Open-ended question titles	Original expressions	Themes
<p>What positive opinions did you have before the OSCE-exam?</p>	<p><i>It is good that the exam was organized despite the exceptional circumstances.</i></p> <p><i>I found it good that in this exceptional situation the Institutes reacted on a quick schedule.</i></p> <p><i>It was positive that there was an alternative way to organize this exam.</i></p>	<p>The possibility to attend the exam despite COVID-19</p>
<p>What negative opinions did you have before the OSCE-exam?</p>	<p><i>I was worried that technology would fail during the online exam.</i></p> <p><i>I was afraid of network connection problems.</i></p> <p><i>I worried about the Moodle site functioning well enough.</i></p>	<p>Worries about technical problems in the online environment</p>

Table 3. Results of the statements (mean and standard deviation SD) concerning the situation before the modified online OSCE, difficulty and implementation of the exam and teaching related to the exam topics.

Statements	Mean (SD)	Scale (reply alternatives)
I received adequate information before the exam	3.8 (1.2)	1=fully disagree to 5=fully agree
I had a positive attitude towards the exam before the exam	4.0 (1.0)	
I found the practice test useful	3.7 (1.1)	
The difficulty of the questions in the online OSCE	2.7 (0.7)	1=poor to 4=excellent.
The technical implementation of the online OSCE	2.9 (0.6)	
The teaching I have received during the studies in relation to the modified OSCE was	3.2 (0.5)	1=completely insufficient to 4=completely sufficient

Table 4. Student assessment (mean, standard deviation SD) of variables of usefulness and interest (together the content) and technical implementation and appropriate time allocated (together the usability) on each question entity (1=poor, 4=excellent). Individual sums and further the means with standard deviations of each question entities and four variables: usefulness, interest, technical implementation and appropriate time allocated as well as the content and the usability.

	Content			Usability			All four variables (Usefulness, Interest, Technical implementation and Appropriate time allocated)
	Usefulness	Interest	Content	Technical implementation	Appropriate time allocated	Usability	
Question entities	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
General emergency	3.2 (0.7)	3.2 (0.7)	3.2 (0.6) *	2.2 (1.0)	2.6 (0.9)	2.4 (0.8)	2.8 (0.6)
Diagnostics of occlusion	3.5 (0.5)	3.4 (0.6)	3.4 (0.5)	3.3 (0.8)	3.4 (0.7)	3.3 (0.6)	3.4 (0.5)
Referral	3.0 (0.8)	3.0 (0.7)	3.0 (0.7) *	2.8 (0.8)	2.6 (1.0)	2.7 (0.7)	2.9 (0.6)
Diagnostics of dental emergency	3.4 (0.6)	3.3 (0.6)	3.3 (0.5) *	2.8 (0.8)	2.5 (1.0)	2.7 (0.8)	3.0 (0.5)
Treatment alternatives for conservative care	3.4 (0.5)	3.2 (0.5)	3.3 (0.5) *	3.3 (0.6)	3.0 (0.8)	3.1 (0.6)	3.2 (0.5)
Treatment related tooth morphology	2.9 (0.9)	2.9 (0.7)	2.9 (0.7)	2.3 (1.0)	3.4 (0.7)	2.8 (0.7)	2.9 (0.6)
Diagnostics and treatment of dental emergency	3.5 (0.6)	3.5 (0.5)	3.5 (0.5)	3.3 (0.7)	3.5 (0.6)	3.4 (0.5)	3.4 (0.5)
Cross infection control	2.7 (0.9)	2.6 (0.8)	2.6 (0.8) *	2.5 (1.0)	3.4 (0.7)	3.0 (0.7)	2.8 (0.6)
All question entities	3.2 (0.5)	3.1 (0.4)	3.2 (0.4) *	2.8 (0.4)	3.0 (0.5)	2.9 (0.4)	3.0 (0.4)

* Statistical significances ($p < 0.05$) were calculated between 'content' and 'usability' using Wilcoxon signed rank test.