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Research Article

Peer-based dental composite training course

Abstract

This multivariate, prospective, monocentric, observational pilot study evaluates the experimental acceptance and feasibility of a peer-based course concept. Those both theoretical and practical workshops were offered to dentistry students in all clinical semesters on a voluntary basis. In 9 courses a total of 45 students took part in small learning groups (n = up to 12 students). For the evaluation a questionnaire was used, which was divided into 4 domains, the competence acquisition consisting of 4 items (A), the acceptance of the course concept with 7 items (B), the framework conditions with 3 items (C) and the recommendation with 2 items (D). The rating was based on a scale of grades (1 = "very good" to 5 = "poor"). In the assessment of the acceptance of the course concept, the following results were obtained in 4 domains: In "A" the subjective optimization of manual skills increased by 0.49 ± 0.86 and the theoretical skills improved by 1.32 ± 0.60 grades. "B" being divided into the subcategories as presentation 1.26 ± 0.34 ; speaker 1.17 ± 0.21 ; visual models 1.26 ± 0.28 ; case examples 1.22 ± 0.24 ; theoretical advices 1.20 ± 0.22 ; practical implementation tips 1.18 ± 0.22 ; practical demonstration 1.22 ± 0.28 .

The framework conditions "C" were subdivided into spatiality 1.34 ± 0.39 ; duration of the course 1.97 ± 0.34 ; media 1.32 ± 0.40 . "D" being stated as the overall grading of 1.24 ± 0.23 and the innovation of the teaching concept of 1.31 ± 0.33 suggest a high acceptance of the short concept. About 55% of the course participants evaluated in the free text like to have had more time to deepen their skills with individual care even more. 84% would be interested in a sequel. An improvement could be assessed by the peer-tutor as they began to get comfortable and more advanced with the composite materials and dental instruments for texturing and polishing used in the course.

The results indicate that extracurricular free courses offered by students to students may well be a useful addition to university settings. It therefore makes sense to support suitable students by teaching staff and, where appropriate, to train in the training of third so that the knowledge can be shared more easily with each other. Through the small learning groups, the skills could be taught more effectively in theoretical and practical terms and it could be targeted to the individual needs of the participating students.

Introduction

The current literature deals with the teaching of course concepts under student guidance [1–4]. Abdalla et al. showed that the learning success of the students does not depend to a large extent on previous knowledge, but is more significantly due to the individual approach to the course participants in small groups [1]. From a subjective point of view by the peer tutor, teaching in small groups also has the advantage that it is easier to respond individually to the participants, and supports them where, there is still room for improvement in the opinion of the course instructor. It also lends itself within these course settings that individual participants can learn directly from the practical skills and possible mistakes of other participants, while those are discussed.

Al Kawas et al. also reported success in evaluating their peer-assisted dental education study [2].

In preparation for their professional life after university studies in dentistry, Cameron et al examined peerassisted learning in 2015 to deepen practical skills and concluded that this course concept on a voluntary basis under student supervision was a good complement to university treatment courses. During the setting, most aspiring dentists will not be able to try out and learn new skills. Rather only existing knowledge is retrieved, and the practical skills are automated, so that in the end, a routine is created that enables most of them to treat complex cases more quickly with success [3].

The Frankfurt study group around Gerhardt-Szép compared the learning success between primary study and replication

study in peer-tutored groups, and showed, with a difference of $\Delta = 0.35$ grading marks, that this teaching concept is better suited for students with some previous knowledge [4].

In their article in 2019, Schwarzbeck et al. reported that students have very different course concepts than experienced medical educators, and therefore, as an interprofessional exchange, it significantly influences the development of dental and medical teaching as student feedback is implemented. A course concept developed by students for students makes it easier to get excited about their own personal development in the subject. Nevertheless, it is necessary for university lecturers to monitor and evaluate the course in order to safeguard the quality of teaching [5].

NCL (Naturomimetic composite layering technique) is a new course concept in the practical training of dentistry students [6]. The optional extracurricular training course includes a theoretical part as well as a structured practical instruction under peer-tutor guidance on phantom models.

The aim of this observational cohort study is the evaluation of the offered settings. The aim of this pilot project, which is currently unique at the dental clinic of the University of Frankfurt am Main, was to find out to what extent students gain a learning progress through the practical demonstration by the course instructor of previously unlearned skills in the individual composite layering technique. Especially the reproduction of the anatomical basic shape of the tooth was evaluated, as well as the individual implementation in the design of the occlusal relief in the posterior region and the macro- and microtexture in the facial surface of the anterior tooth (Figure 1).

The following main research question appears important for undergraduate peer-based teaching in dentistry: How do the students rate a peer-based composite training course specified by a hands-on module combined with a theoretical part?

Materials and Methods

Study period and setting

For this study the data of 9 courses (each lasting 6 hours) with a total of 45 participants (88.9% female and 11.1% male) were evaluated in the period from July 2018 to February 2019 (Table 1).

The questionnaire

For this purpose, the instrument was divided into 4 domains, the competence acquisition consisting of 4 items, the acceptance of the course concept with 7 items, the framework conditions with 3 items and the recommendation with 2 items. The rating was based on a scale of grades (1 = "very good" to 5 = "poor"). In addition, free text information regarding optimization suggestions and personal expectations were evaluated. Within a free text field, the students could write down their personal thoughts on this course concept and had the chance to mention any requests for improvement.



Figure 1: Anterior tooth composite layering on one of the models used in the course: Steps showed: palatal enamel wall, dentin-core layering, superficial dentin layering with mamelons, vestibular enamel layer with colored accents.

Table 1: Distribution of participating students in the different semesters, including average age and gender (clin. = clinical, sem. = semester). Participating and evaluating students are the same due to every student who participated also was willing to evaluate.

Semester	Number	Men	Women	Age
1st clin. sem.	24	1	23	22.1
2nd clin. sem.	10	3	7	22.7
3rd clin. sem.	2	1	1	23.5
4th clin. sem.	2	0	2	25.0
5th clin. sem.	7	0	7	26.3
Total	45	5	40	22.8

The course materials

The composite layering course for direct restorations was free of costs for the participating students.

The theoretical part

The theoretical part includes a lecture with case studies from patient treatment as well as the schematic procedure for the structured processing of direct composite restorations. In the beginning, it was important for the participants to have understood the exact anatomical design of anterior and posterior teeth, including the design of features such as facets, margins, mamelons, and occlusal reliefs.

It is discussed how teeth can be artificially aged by restorations with the help of certain color deposits, the imprints of enamel fractures or abrasion marks on cutting edges, so that it results in a harmonious overall picture with the residual dentition of the patient. The age of a tooth is also defined by the brightness and translucency of the enamel, which is layered in the individual layering technique of composites following the dentin masses.

The practical hands-on module

Within the practical hands-on part, the students receive of

live demonstration of how a naturomimetic composite layering works within the direct restoration of an entire incisor crown placed in a plaster model.

After this introduction, the students could gain their own experience with the materials, being supported and guided by the student tutor at all time.

The composite material consists of different shades of dentin and enamel masses. For individual coloring there are stains in form of flowable composites, which are placed in the enamel layer. The course setting also included a step-by-step demonstration of an adequate macro and micro texturing of the restoration's surface followed by a 3-step polishing procedure with diamond and alumina paste with different brushes and felt wheels.

The peer-assistance

At the time of the courses presented in this study the peer-tutor was in the 3rd and later in the 4th clinical semester of his dentistry studies. As part of further education, dental competitions and intensive training on this project, he prepared himself through the support and critical feedback of a mentor, who had a doctoral and Master of Medical Education diploma. In preparation for the courses, plaster models of dentate jaws were made, into which the composite restorations for the anterior teeth area were placed. For posterior restorations, extracted teeth were socketed as a model. In addition to this also anterior tooth models were fabricated out of extracted teeth. Those were used for exercised for finding the exact coloring and modelling precise characteristics such as abrasion marks and minor color deposits into the edge reconstruction.

Data security

The questionnaires were evaluated anonymously so that it was impossible to trace the answers back to individuals.

This ensured the objectivity in summarizing the data for the evaluation.

Results

All the 45 participants (average age 22.8 ± 0.8 years) participated in the evaluation (Table 1). In the subjective assessment of skill acquisition, 100% of the respondents expected after the course an improvement of the theoretical knowledge by 1.32 ± 0.60 points and a subjective optimization of the manual skills of 0.49 ± 0.86 . In the assessment of the acceptance of the course concept, the following results were obtained: presentation 1.26 ± 0.34 ; speaker 1.17 ± 0.21 ; visual models 1.26 ± 0.28 ; case examples 1.22 ± 0.24 ; practical implementation tips 1.18 ± 0.22 ; theoretical advices 1.20 ± 0.22 ; practical demonstration 1.22 ± 0.28 . The framework conditions were subdivided into spatiality 1.34 ± 0.39 ; duration of the course 1.97 ± 0.34 ; media 1.32 ± 0.40 . The overall grading of 1.24 ± 0.23 and the innovation of the teaching concept of 1.31 ± 0.33 suggest a high acceptance of the short concept. About 55% of the course participants evaluated in the free text like to have had more time to deepen their skills with individual care even more. 84% would be interested in a sequel (Table 2).

Response rate

The response rate for all semesters was 100% with no student at all in the drop-out rate.

Free text information for evaluation

In the open field, the students were able to write down comments and suggestions for improvement. The personal expectations were met in all cases and the small course size, explicitly mentioned in 7 cases, was found to be positive on the occasion.

Twelve other students thanked in writing for the great

Table 2: Evaluation of the questionnaire on the peer based dental training course.

Domains	Factors to be evaluated	Mean	Median	SD	Min	Max
A	Before the training course, I would rate my knowledge as follows:	3.18	3.0	0.52	2.3	4.0
A	After the training course, I would rate my knowledge as follows:	1.86	2.0	0.19	1.3	2.0
A	My manual skills in dealing with composite before the training course (self-assessment):	2.62	2.9	0.48	2.0	3.3
A	I was able to improve my manual skills to the following level (self-assessment):	1.76	1.7	0.24	1.3	2.3
B	How was the quality of the presentation?	1.26	1.0	0.34	1.0	2.0
B	How was the quality of the peer student?	1.17	1.1	0.21	1.0	1.7
B	Did the display models help to haptic and visual clarification?	1.26	1.2	0.28	1.0	2.0
B	How comprehensible were the case examples used on the patient case reports?	1.22	1.1	0.24	1.0	1.7
B	There were individual tips / suggestions for improvement. How helpful were these?	1.20	1.2	0.22	1.0	2.0
B	The peer student responded adequately to questions related to the practical implementation.	1.18	1.1	0.22	1.0	1.7
B	How helpful was the demonstration of the processes on the model?	1.22	1.1	0.28	1.0	2.0
C	Space within the training course room and the workspace	1.34	1.2	0.39	1.0	2.3
C	Was the duration of the training course reasonable?	1.97	2.0	0.34	1.3	2.7
C	Was the use of media targeted?	1.32	1.2	0.40	1.0	2.3
D	I would recommend this training course to other students with the following grading.	1.23	1.2	0.23	1.0	1.7
D	How innovative would I describe the concept of this training course?	1.31	1.2	0.33	1.0	2.0

experience, as this course offer is currently unique in extracurricular dental education and mentioned the instructor's commitment as outstanding.

Answering the main research question

This study has shown that undergraduate and graduate extracurricular peer-education courses are readily accepted by students and are also highly valued by the individual care provided during such a course. At the same time, a great learning success of the participants is noticeable.

Discussion

The results show that the peer-assisted course concept was consistently rated as good to very good and that only small values of the standard deviation occurred. This shows that all values are very close to each other. The peer observation of the participants' development in terms of their practical abilities in relation to the students' own assessment before and after the course makes it impossible to make a consistent statement. The own rating was relatively good in most cases. Of course, this is also because the students only had themselves and the other participants as a comparison. In comparable studies Böckers et al. show that advanced students have a lower interest in such courses. Especially men tend to overestimate themselves and to oppose such an extracurricular offer to improve their own practical skills. Male showed with 36.7% a lower acceptance than female with 62.4% for additional course offers [7]. That fact can be confirmed in the evaluation of the participants in relation to the respective clinical semester and the gender of the participants within this study (Table 1). The findings regarding the character attitude to such courses in relation to different groups of dental students could be noticed also by Lichtenstein et al. 2018 in a comparison of two German universities [8]. Bugaj et al. mention in their literature review that too intense and critical feedback hinders the development of practical skills of young participants rather than promoting them. However, a regular and constructive feedback in combination with praise for well-done tasks is the right tool to optimize the learning success and the practical implementation in the shortest possible time [9]. Reichel et al, Vogel et al and Vogt et al also confirmed these observations of improved communication of giving feed-back [10-12].

This is how it was done in the course setting described here, because of course the peer-tutor also knew from his own experience that especially at the beginning of learning these skills not introduced into regular university teaching, a trial and experience can optimize the subsequent success later on.

As in the case of Ciardo et al., the subjective learning success could be proven in another Frankfurt study group. However, this course presented there is a curricular university course and not facilitated by peer tutoring. The study showed that at the end of a semester, students were able to assess their own practical performance so well that their estimate (3.66 ± 0.62) was nearly identical to that of the examiners (3.69 ± 0.83) [13]. Since the course on nature-identical composite layering, however, was based on a voluntary basis and for organizational

reasons could not be offered at regular intervals throughout the semester, no parallel can be drawn here. However, it can be guessed by the personal assessment of the peer-tutor that as described above with more practice also an objective view of their own practical skills develops.

Deeb et al. studied the different successes between course concepts with theoretical and practical part and those in which students without theoretical guidance should complete the practical part. With a significance it could be proven that extensive theoretical knowledge, as taught in the NCL course, maximizes the success [14].

From a simulated treatment situation with realistic models, students still benefit the most as stated by Hölzer et al. in 2017. Although 275 participants were evaluated over a period of 3 years in their courses, in the end no significant difference in the success of more exercise sessions could be drawn to a single-day-course.

A statistically unclear evaluation shows that with increasing innovativeness of the course concept also the interest and at the same time the individual learning success increases. However, this could not be substantiated by significant numerical values [15].

In terms of preparation for exam situations Johnson et al. show that students who had been tutored had a significantly lower failure rate than those who were not tutored (20% vs. 80%, respectively). Elsewhere over a four-year period it could be reported that students who had been tutored in a certain oral health subject passed their exams with a rate of 94% [16]. However, these evaluations refer to theoretical knowledge and not to practical course content, it does show that students have more success if they can learn from the experience of other students.

Ratzmann et al. compared two groups of students with the same course content in their study and found that the students who were enabled to evaluate the course offer were more enthusiastic and used problem-oriented learning more effectively [17]. For this reason, it was beyond doubt at the foundation of the NCL-course that the participants were offered an evaluation, which was also accepted by all.

A success for both the participants and the peer-tutors, who will certainly also gain practical experience in teaching content through this teaching concept, has been shown in all the studies listed here, although this success is not always mathematically expressible, due to the subjective standards of evaluation [18].

As clarified by the results the participating students rate the hands-on course combined with the introductory theoretical part good to very well. Such results are also shared by other studies as discussed above. Though the more advanced students get in practical things the more they also tend to become not as interested in such extracurricular offers as younger students. In parts of gender, male students even more show up with an attitude like this, although there are of course ones who are

very keen to learn new things they might need after leaving university and going into practice. This could be stated with the overall number of students of different gender who entered the course. When decided to participate all the students were almost the same in terms of how enthusiastic they took part and how they processed throughout the course.

Conclusion

There is a positive effect on acceptance. The results of the evaluation have contributed to an optimization of the peer-led training course offer. An improvement of the evaluation instrument is sought. Throughout, the feedback from the fellow students was positive, sometimes even with great enthusiasm for this series of events. However, everyone came to the consensus that a timeframe of up to 6 hours is too short, and they would like to get even more exercise in the individual layering technique through further course offerings. The results indicate that extracurricular free courses offered by students to students may well be a useful addition to university courses. It therefore makes sense to support suitable students by teaching staff and, where appropriate, to train in the training of third so that the knowledge can be shared more easily with each other. Through the small learning groups, the skills could be taught more effectively in theoretical and practical terms and it could be targeted to the individual needs of the participating students.

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