SELF-ASSESSMENT OF DENTAL PREPARATIONS IN THE PHANTOM HEAD WITH PREPCHECK - A QUESTIONNAIRE-BASED EVALUATION

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ABSTRACT

Background: As part of pre-clinical teaching at Danube Private University (DPU), CAD/CAM systems (CEREC) are introduced in the third semester. In addition, students learn how to use software for self-assessment of their dental preparations in the phantom head (prepCheck).

Objectives: The students' perspective and feedback is important for the success of teaching modules, which is why their opinion of the prepCheck analysis app was evaluated by means of an anonymous questionnaire.

Methods: A survey study was conducted with an anonymized questionnaire. This was followed by a descriptive statistical analysis of the ratings of the statements.

Results: The use of prepCheck was predominantly evaluated positively and the learning content was positively received. The training of assessment skills as well as the promotion of study motivation, the acquisition of a better understanding and the optimized self-assessment through prepCheck could also be affirmed. However, prepCheck cannot replace teacher feedback.

Conclusion: Besides traditional teaching and performance assessment by the teacher, prepCheck is positively perceived as an additional teaching and self-assessment method.

Key words: prepCheck, dental education, self-assessment, preclinical preparation course

INTRODUCTION

During dental school, students ought to acquire practical skills to prepare teeth to receive different types of restorations. Usually, these skills are acquired on acrylic teeth in phantom heads with feedback from clinical or senior clinical lecturers. In such a teaching/learning environment, learning success is typically determined by visual preparation assessment of several examining clinical or senior clinical lecturers. Unfortunately, in contrast to the intended objective verification of learning outcomes [1-3], conventional assessment by visual inspection has been shown to be subjective and inconsistent [1, 4-6].

To eliminate this variability, computer-aided learning (CAL) software has been developed, e.g., the prepCheck application (Dentsply Sirona Global Headquarters, Charlotte, USA) [1]. The PrepCheck analysis software is installed on the Sirona CEREC-AC (Dentsply Sirona Global Headquarters, Charlotte, USA) unit. Basically, prepCheck compares and evaluates a master preparation with the student´s preparation. This allows

the user to receive objective and consistent feedback through the computerized scoring system.

At Danube Private University (Krems an der Donau, Austria), prepCheck is used, in addition to traditional visual assessment by clinical or senior clinical lecturers, to objectify the verification of practical learning outcomes.

Against the background of including the student perspective in the design of undergraduate curricula, the basic aim of this questionnaire-based study was to find out what dental students think about prepCheck (as one aspect of computer-aided-learning) used for guided self-assessment within the "Course in Dental Technology" in the 3rd semester. In so doing, in particular it was important for us to know whether the 3rd semester students consider feedback from lecturers to be necessary in addition to prepCheck. Thereby, based on previous experience, it was hypothesized that prepCheck cannot completely replace teacher feedback.

MATHERIALS AND METHODS

As part of the Department of Prosthodontics and Biomaterials at our dental faculty (Danube Private University, Krems an der Donau, Austria), a teaching concept was developed that introduces students to digital dentistry as early as the third semester and allows them - among other things - to use the prepCheck analysis software.

Overall, the components of the comprehensive concept are already taught in the 1st semester with the preparation of crowns on model teeth in the phantom head. Thereby, the level of difficulty and scope of the preparations and the associated demands on the students are increased from course block to course block over the individual semesters. In the 3rd semester, students are familiarized with the CEREC chairside workflow and trained in the use of the prepCheck analysis software. In this way, students can use prepCheck to quickly and effectively evaluate their model teeth prepared in the phantom head. In addition, experienced clinical lecturers as well as senior clinical lecturers are present to provide additional assessment of the preparations, feedback, and guidance to the students. This is later followed in the 5th semester by the "Phantom Course - Prosthodontics", in the 6th semester by the "Integral Phantom Course - Digital Dentistry and CAD/CAM (CEREC)" and in the 7th semester shortly before entering student patient treatment by the "Phantom Course - Clinical Perfection in Prosthodontics and CEREC" (Figure 1).

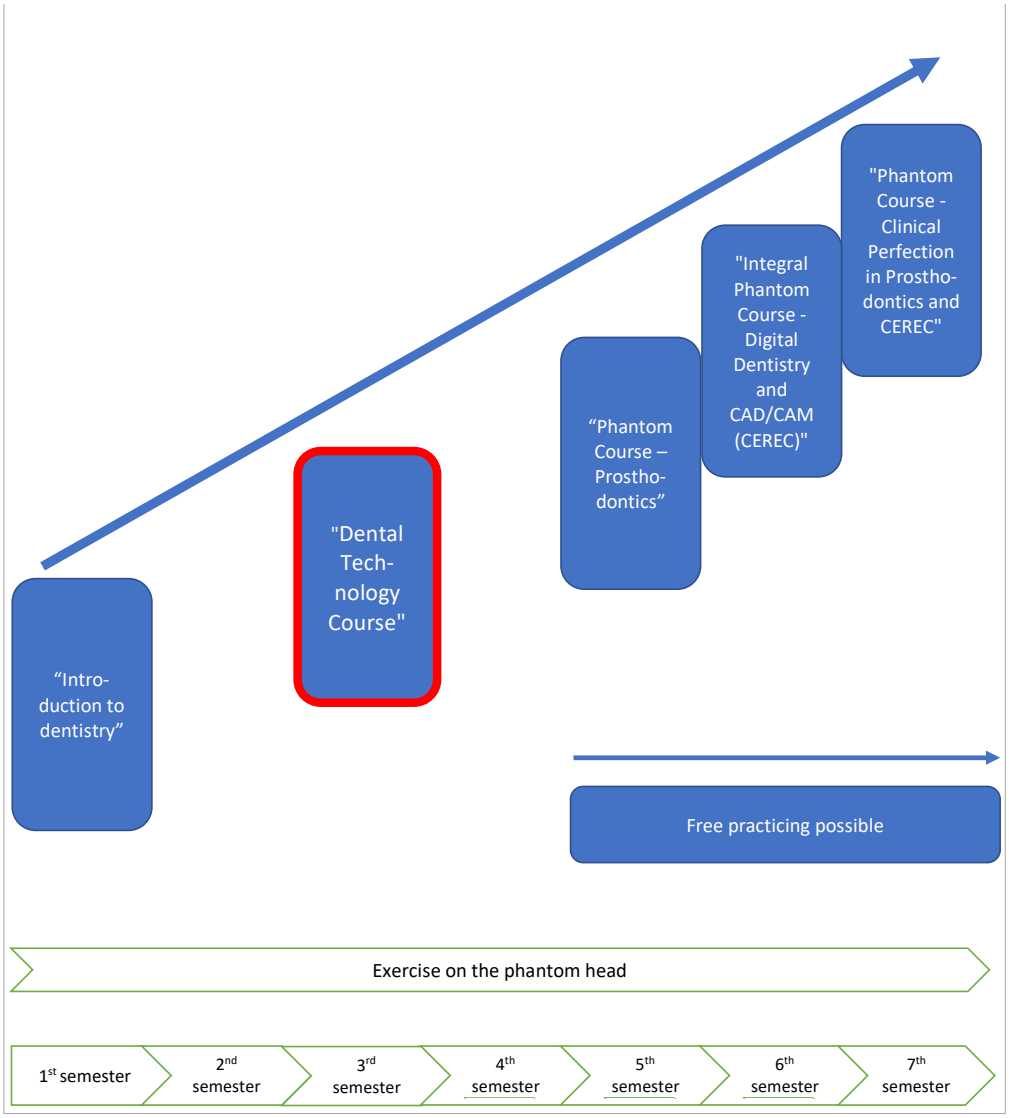

Figure 1. Comprehensive, pre-clinical teaching concept

In the 3rd semester, teeth 36 and 46 are prepared by the students in the phantom head for a single crown restoration and teeth 34 and 36 or 44 and 46 for a fixed denture (FDP, bridge). The preparations are made according to the guidelines for the preparation of all-ceramic crowns, adapted for Vita Enamic® (Vita Zahnfabrik, H. Rauter GmbH & Co. KG, Bad Säckingen, Germany) for the crown restoration and IPS e.max ZirCAD Prime® (Ivoclar Vivadent GmbH, Ellwangen, Germany) for FDP. To check the preparation accuracy (according to the established guidelines), students as well as clinical or senior clinical lecturers first use silicone precoats and a periodontal probe with millimetre graduation (Figure 2).

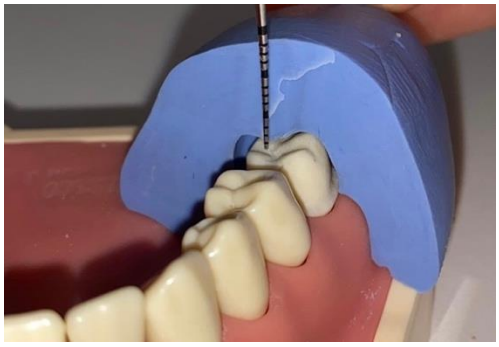

Figure 2. Preparation accuracy check (according to the established guidelines with silicone precoats and a periodontal probe)

For the prepCheck analysis, a "master preparation" (ideally the exact implementation of the specified preparation guidelines) was scanned with an intraoral scanner (Primscan; Dentsply Sirona Global Headquarters, Charlotte, USA, CEREC Software 5.2, Dentsply Sirona Global Headquarters, Charlotte, USA) and serves as a template. All student preparations are to be compared with this "master preparation" (i.e., 3D comparison with the master preparation). This is done independently by the students and then discussed with a tutor specially trained for prepCheck (Figure 3 & Figure 4).

Within prepCheck, the preparation can be evaluated according to various parameters (undercut, preparation angle, occlusal reduction, axial reduction, margin type, preparation margin, analysis of adjacent teeth), giving the student maximum feedback on their preparation. In addition, the colour coding enables the information to be recorded quickly and comprehensibly.

If there were major differences from the master preparation, the students were asked to make the necessary improvements. This was followed by another check in the analysis software.

A single crown was then designed, fabricated, and adapted to the image of the prepared tooth stump using CEREC hardware and software for the material Vita Enamic®.

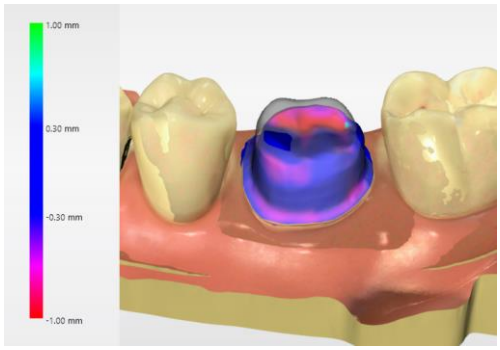

Figure 2. Comparison of student preparation with master preparation (colored = student preparation, white = master preparation)

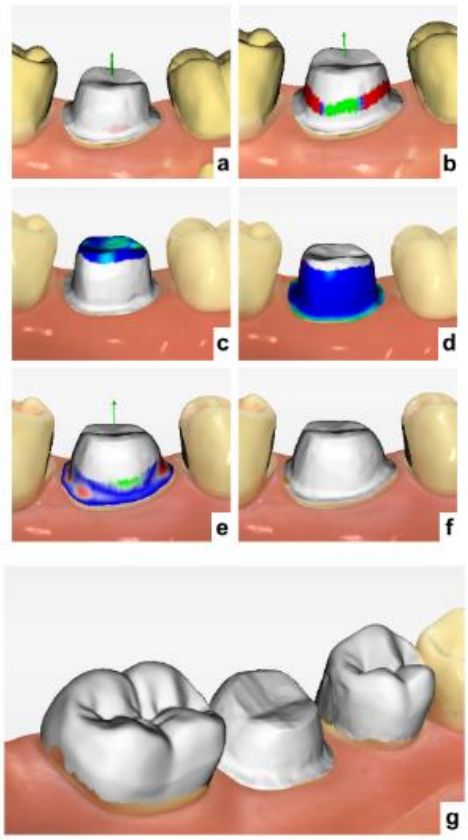

Figure 3 Digital preparation analysis with predefined parameters (a = undercut, b = preparation angle, c = occlusal reduction, d = axial reduction, e = margin type, f = preparation margin, g = analysis of adjacent teeth)

In order to determine how well this course was received by the students and how successfully prepCheck could be used as a didactic tool for the objective evaluation of preparations, a survey of the students was conducted after the course using a specially developed questionnaire.

An existing questionnaire (questionnaire: prepCheck) from the company Dentsply Sirona (created by Dipl.-Ing. Roland Felber, on 27.01.2020; Dentsply Sirona Deutschland GmbH, Bensheim, Germany) was adapted and supplemented as part of the study.

The anonymous questionnaire contained - in addition to general information (gender, age, profession / semester of study) - statements to be evaluated regarding the prepCheck analysis app (assessment of preparation, feedback on self-study; Figure 5).

The evaluation of the statements was basically done on a five-point Likert scale [7]. Exceptions were statement 16 (yes/no answer) and statement 22 (school grade answer). Further, it was important for us to know whether the 3rd semester students consider feedback from lecturers to be important in addition to the software (questionnaire - item 15: "I am of the opinion that prepCheck cannot completely replace lecturers"). At the end of the questionnaire, a field was added where students could write down any thoughts about prepCheck. For tabulation and evaluation, the questionnaires were provided with generated codes.

A descriptive statistical analysis of the ratings of the statements was done. Absolute and relative frequencies (percentages) of the different Likert scale answers, the dichotomous (yes/no) scale and the evaluation in the school grading system were calculated. The analysis was accomplished analogously to Schlenz et al [8, 9] to enable a comparison of the two studies. The analysis was carried out with Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) and IBM SPSS Statistics (version 27; International Business Machines Corporation (IBM), Armonk, New York, USA).

Survey prepCheck

	General information					
	Gender (please tick)	female	male	diverse		
	Age (please specify years)					
	Profession / Semester					
	prepCheck concept *„Computer-aided-learning"*	Do not agree at all	Do not agree	Undiceded	Agree	Totally agree
1	I have understood the functions and benefits of prepCheck. Through the lecture, the demonstration and the exercise I feel able to evaluate my preparation independently with prepCheck.					
2	The menu navigation of the Primescan intraoral camera and the prepCheck software is easy to understand and to follow.					
3	The scanning process with the Primescan intraoral camera is intuitive.					
4	The image quality of the Primescan intraoral camera is impressive.					
5	When assessing the preparation using prepCheck is well feasible.					
	When assessing the preparation using prepCheck, I can (in comparison without prepCheck)					
6	a. better assess occlusal reduction.					
7	b. better assess circular reduction.					
8	c. better assess the preparation of the chamfer (sufficient tooth structure removal).					
9	d. better assess the preparation angles.					
10	e. better recognize undercuts.					
11	f. Identify sharp edges and roughness on the surface / preparation border more easily.					
12	By displaying my own preparation on the monitor and analysing it with prepCheck, my own ability to assess preparations is trained.					
13	The prepCheck report is easy to understand.					
14	I am of the opinion that with the help of prepCheck you can also practise preparing on your own, e.g. in free practice sessions, with effective feedback.					
15	I am of the opinion that prepCheck cannot completely replace lecturers.					
16	By being able to use prepCheck, I will also gain knowledge about the digital workflow in intraoral scanning.	Yes	No			
17	The use of new, digital technologies (e.g. prepCheck) at an early stage of the study motivates me.					
18	Assessing my own preparation with prepCheck gives me a safe, good feeling and motivates me.					
19	Through prepCheck (compared to without prepCheck) I have a very good three-dimensional idea of my preparation and I am sure that it meets the requirements.					
20	For the students, the use of prepCheck can be associated with advantages.					
21	I am sure that prepCheck can further optimise dental school education.					
22	Give the prepCheck a rating between 1 and 5 (5 = poor, 1= excellent)	1	2	3	4	5
23	Here you can get rid of anything else that comes to mind about the use of the prepCheck:					

Figure 4. Questionnaire for the analysis app prepCheck ("computer-aided-learning")

RESULTS

The questionnaires were distributed to all 3rd semester students in study groups 22, 23 and 24 (G22S3, G23S3, G24S3), in total 137 students, and subsequently completed and 117 returned. This corresponds to a high return rate of 87%. The questionnaires were collected in February 2021. Participation in the study was voluntary and, according to the chair of the DPU ethics committee, did not require a vote by the ethics committee.

If information was missing from the questionnaire itself, it was excluded from the respective analysis. Thus, no attempt was

made to fill in missing information.

The participants were on average 23 years old (SD 3.7). The youngest participant was 19 and the oldest 46 years old. Half of the participants were women (49.6 %).

The question of whether prepCheck as a digital method for self-monitoring and thus for self-directed learning of dental preparations (our special interest; statements 1 to 5, 13 and 14) was easily understood and positively received was fully agreed or agreed with by at least ninety percent of the get back questionnaires (Fig. 6). Further, the question whether the three-dimensional representation of one's own preparation leads to a competent assessment for self-directed learning (statements 6 to 12) was also answered in the affirmative in at least eighty-seven per cent of the questionnaires (Fig. 6). Also, participants fully agreed or agreed that the early use of prepCheck motivated them for their further studies and gave them the feeling that they fulfilled the requirements (statements 17 to 21; at least eighty-six per cent of the questionnaires; Fig. 6). Furthermore, the additionally acquired competence in intraoral scanning was also positively evaluated (statement 16; affirmation over ninety percent; Fig. 7). However, prepCheck is not seen as a complete substitute for teacher feedback (statement 15; eighty-five percent of questionnaires; Fig. 6).

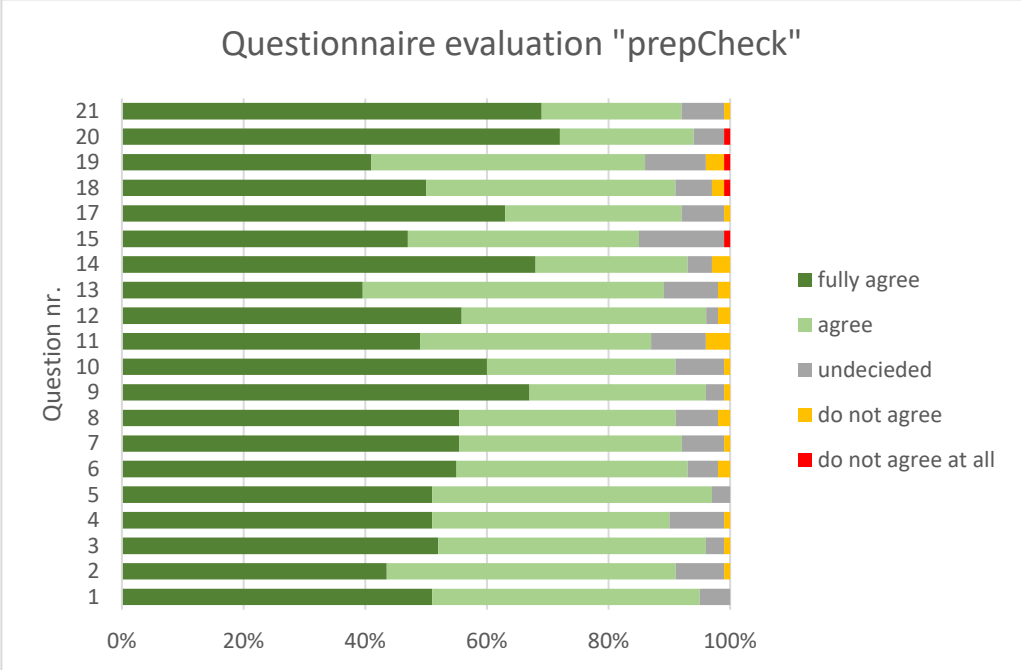

Figure 6. Survey results for "prepCheck" - statements 1 – 15 & 17 – 21 of the questionaire

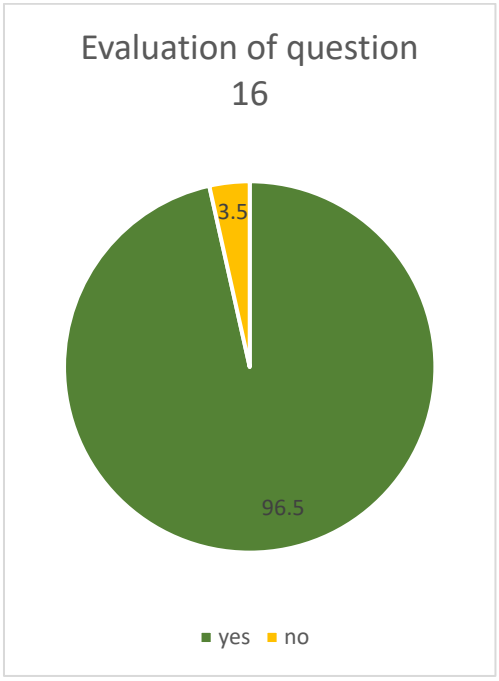

Figure 7. Result for "prepCheck" - statement 16: "By being able to use prepCheck, I will also gain knowledge about the digital workflow in intraoral scanning."

In addition, prepCheck was rated good or better overall in eighty-five percent of the get-back questionnaires (statement 22; excellent: 49%, good: 36%, fair: 1%, sufficient: 9%, poor: 6%;
Fig.8).

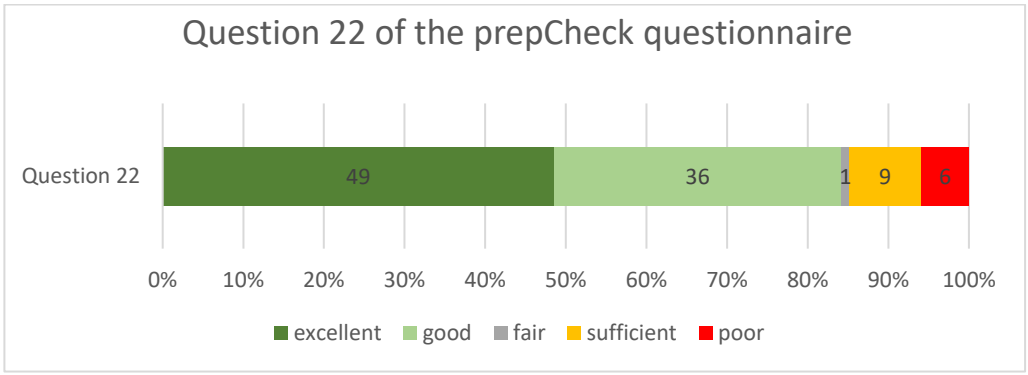

Figure 8. Results for "prepCheck" - question 22: "Give the prepCheck a rating between 1 and 5 (5 = poor, 1= excellent)"

In addition, the participating students had the opportunity to make positive or negative comments. Fifteen of the one hundred and seventeen returned questionnaires contained such comments. It was mentioned that prepCheck is intuitive, easy to understand, fun and very helpful in the learning environment. However, as mentioned above, prepCheck is not seen as a complete substitute for teacher feedback. Furthermore, analysis with prepCheck was perceived as time-consuming and very rigorous and could therefore be demotivating.

DISCUSSION

Here, a questionnaire-based study was conducted to find out what dental students in the 3rd pre-clinical semester think about prepCheck as a tool for guided self-assessment. It was important for us to know whether these students consider feedback from lecturers necessary in addition to prepCheck. Based on previous experience, it was hypothesized that prepCheck cannot completely replace teacher feedback.

In principle, prep-Check was positively received by the students in the 3rd pre-clinical semester. Irrespective of this, however, our hypothesis could be confirmed that prepCheck cannot completely replace teacher feedback, at least at such an early stage in the study of dentistry.

In principle, these results are to be regarded as meaningful. The statements and thus the underlying questions in the questionnaire were kept simple and understandable and should therefore have led to objective answers. In addition, the number of questionnaires evaluated is relatively high (more than one hundred) and the statements were predominantly rated on the five-point Likert scale. Out of 137 questionnaires distributed, 117 were returned and included in the study. Which results in a participation of 87% of the students, which suggests a very high motivation of the students in this course. However, due to the voluntary participation of the students in the survey, there might be a slight risk of bias. This should be taken into account when transferring the results presented.

Due to the rapid progress of digitalization, the requirements for a contemporary and future-oriented study of dentistry lie in a field of tension between tradition and modernity. Thus, on the one hand, there are demands from students who advocate the use of computer-based learning methods within the framework of university education [8], or corresponding recommendations for the integration of modern simulation trainers [9] and digital technologies [10]. On the other hand, a radical change from conventional teaching methods is discourage [11].

The teaching concept of the Centre for Dental Prosthetics and Biomaterials at Danube Private University (DPU) meets these requirements - starting from a conservative basic attitude to offering contemporary and future-oriented dental study content in the pre-clinical study environment. Our concept is based on the step-by-step introduction of digital systems (e.g., Digital Chairside Dentistry with CEREC) and methods (e.g., analysis app prepCheck) into the pre-clinical curriculum at DPU. The courses in the different semesters build on each other logically and first impart knowledge, understanding and skills without the use of digital systems and methods and only then with the use of digital systems and methods. Such a "step-by-step principle" is also discussed

positively in the scientific literature [8]. The investigation of student perceptions of new components in established courses by means of anonymous questionnaires (here: in the 3rd semester in the course of dental technology – the analysis app prepCheck) was also perceived positively by the students and reflects the usefulness of allowing student perceptions and wishes to flow into the planning of courses and ultimately the curriculum [11, 12].

The evaluation of the questionnaires shows that the prepCheck analysis app was predominantly positively received and evaluated (also as an enrichment of learning). Other aspects that are certainly also included in this positive evaluation of the students are the extremely high commitment of the teachers, the very good contact with industry partners who are involved in the teaching environment and the short as well as efficient paths and decision-making structures of a private university. The latter especially against the background that such teaching can be very cost-intensive [1, 13, 14].

CONCLUSIONS

Within the limits of this study, it can be concluded (1) that the integration of prepCheck into the course "Dental Technology Course" in the 3rd semester can be regarded as forward-looking and sensible, but (2) that prepCheck cannot replace the feedback of an experienced teacher. The didactic approach of integrating CAL into preclinical preparatory courses is thus one way of adequately and consistently imparting knowledge around preparation design. However, computer-assisted learning cannot replace human instruction and demonstration of preparation techniques, but it can support them very well.

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