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Comparison of digital and traditional assessment methods in crown preparation: Pilot study

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Abstract
Background: The use of technology in dentistry has opened up numerous possibilities for digital education. However, it is crucial and important to select the most appropriate pedagogical approaches to ensure that learning is both effective and efficient. This study aims to explore the efficiency of incorporating technology in teaching and assessment methods to enhance preclinical skills of undergraduate students, in comparison to traditional methods.
Materials and Methods: Our pilot study was conducted with 5 students in the Faculty of Dentistry, who utilized a combination of PrepCheck software, CAD/CAM unit, Cerec Omnicam, computers, and phantom tooth models. In our study, we focused on the chamfer-type tooth preparation of teeth 27, and laminate veneer preparation of teeth 21. The duration of the tooth preparation exercise assigned to the students was set at two hours. We conducted both traditional and digital evaluations on the models, examining six different parameters, including undercut, taper, occlusal distance, preparation type, margin quality, and surface quality. The collected data sets were subjected to a Shapiro-Wilk normality test, which revealed non-normal distributions in the data sets ($p< 0.05$). Consequently, the Wilcoxon test was employed to compare traditional and digital measurements on the non-normal data set.
Results: This study analysis showed that the measurements of undercut and preparation type in tooth 27 were not notably different, but there were statistically significant differences in other parameters ($p<0.05$). The evaluation of tooth 21 showed that there was no significant variance between the traditional and digital techniques used to measure occlusal distance. Nevertheless, in other groups, the difference was statistically significant ($p<0.05$).
Conclutions: When assessing the effectiveness of digital education programs in dental education, our research revealed that digital and traditional evaluations did not align with each other. This suggests that the digital and traditional methods are not generally compatible.

Keywords: CAD/CAM, digital dentistry, dental education, digital assessment, undergraduate students, Prep Check software

1. Introduction
The importance of dental education in preparing future generations of oral health practitioners cannot be emphasized enough. With the emergence of novel educational strategies and their implementation, dental education will inevitably undergo further evolution and transformation [1]. In the field of dentistry, the use of digital technologies is growing rapidly, with a particular focus on computer-aided design/computer-aided manufacturing (CAD/CAM) for dental restorations and devices. The traditional production method for fixed dental prostheses (FDPs) involves multiple manual steps, both from the dentist and the dental laboratory, but this can be greatly simplified by implementation of CAD/CAM technologies [2, 3].
With the continuous advancement of digital dental technology, digital technologies have increasingly been incorporated into dental education, especially in preclinical training [4]. One such technology is the digital training system used in prosthetics and restorative dental training, which has the potential to replace traditional apprentice-style training methods. This involves demonstrating preparation of the tooth and restorative dental techniques on a phantom head and having trainers check students' practical work. However, prior research has indicated that the use of the digital training system in prosthetics and restorative dental training

may lead to notable discrepancies in the assessment of students' work, both within and between individuals [5-7]. The integration of technology in education has led to the emergence of computer-assisted learning (CAL) and computer-assisted simulation (CAS) systems. These methods offer an interactive learning experience and allow for flexible time management by students, thanks to their wide availability [8].

Currently, there are two primary types of digital dental education systems available: digital evaluation systems, which provide feedback on student preparation using programs like PrepCheck (Dentsply Sirona, Bensheim, Germany), Dental Teacher (KaVo, Biberach, Germany), and Compare (Planmeca, Helsinki, Finland), and force-feedback-based simulators, which utilize a haptic device and virtual models of human teeth or the oral cavity to allow for the practice of dental procedures. Examples of force-feedback-based simulators include Dente/SIMtoCare (Vreeland, Netherlands), HapTEL (Birmingham, England), and Forsslund [9, 10].

Using traditional methods in preclinical dental training has its advantages such as low cost, improving hand-eye coordination, and manual dexterity. This method has been the preferred choice for decades. However, there are also major drawbacks such as the inability to calibrate the evaluation process, heavy reliance on subjective instructor evaluation, and lack of consistency in student evaluations. To address these limitations, computerized dental teaching and assessment systems have been proposed as potential alternatives to provide consistent feedback and improve student learning and self-assessment experiences [11].

Digital programs in dental education have a primary objective of helping students identify and rectify errors in their work, while also easing the burden of trainers during monitoring and progress inspections. They strive to provide an objective and uniform evaluation of students' capabilities, which traditional subjective methods may not achieve, and to enhance students' ability to self-assess their work [12-14]. Digital dental education systems, offer the advantage of allowing students to learn at their own pace and access the programs as needed. This can ultimately reduce the workload of faculty staff over time. However, implementing these systems into an existing curriculum can be time-consuming and require significant initial investment costs [15]. Moreover, the requirement for extra equipment, which could vary based on the number of students, can be a significant obstacle. Hence, it is crucial to carefully contemplate these constraints when integrating digital measurement and evaluation systems into dental education [16].

The main objective of this pilot study was to evaluate the effectiveness, consistency, ease of use, and reliability of digital dental education systems with the ultimate aim of integrating them into future educational programs. In order to achieve this, we compared assessments made by faculty staff with those generated by digital education systems. Our hypotheses are: 1) There is a correlation between conventional and digital assessments, and 2) The prepCheck analysis program can serve as a viable substitute for traditional assessment methods in dental education.

2. Materials and Methods

During the academic year of 2017-2018, thsi study was conducted at the Zonguldak Bülent Ecevit University Faculty of Dentistry, with the aim of supporting prosthetic dentistry internship courses in a phantom dental laboratory. The study involved 5 volunteer students from Term IV, and the students performed a chamfer type preparation and laminate veneer preparation of tooth, procedure on phantom models of teeth 27 and 21, during a single session held in the phantom laboratory. The task was performed using a particular type of phantom models (Cataloglu Dental, Karatay / Konya). After approximately 3 hours, the students submitted their work for evaluation. Cerec Omnicam was used to scan all phantom models, and their margins, axes, and access paths were marked.

Digital evaluation systems and force-feedback-based simulators are commonly utilized in pre-clinical dental education. In these systems, students scan their prepared training tooth using digital technology and compare it with a master preparation designated by their instructor. The data were then transferred to prepCheck 2.0 (Sirona, Germany) for further analysis.

The evaluation of the chamfer teeth and laminate veneer preparations made by the students was carried out using the PrepCheck 2.0 software, which analyzed six distinct parameters. These parameters included the analysis of undercut, preparation type, margin quality, preparation taper, distance between preparation and the opposite jaw, and surface quality. After the scans were transferred to the PrepCheck software, the results were presented in a report through the PrepCheck Report, which used a graph to display the parameters in colors according to the percentage slice (Figure 1).

The variations between the prepared models and the reference models are illustrated through a color-coded scale, as well as by displaying the measured angles and metric values. The students have the ability to view the models from all angles and can use the zoom function to obtain a more detailed perspective. Those systems offer the capability to compare different types of preparations.

The PrepCheck system, developed by Dentsply Sirona (Dentsply Sirona, Bensheim, Germany), builds upon the existing CEREC system (including the CEREC AC and CEREC InLab software) and incorporates the PrepCheck-app. The system utilizes either the Omnicam or Primescan intraoral scanning devices. To use the system, students must create a patient and follow the same workflow used in clinical practice. This provides the benefit of simulating a real clinical setting. The system is portable, as it is mounted on a cart that can be placed at the students' workstations. However, the scanning process can be time-consuming, as it requires multiple steps within the software.

2.1 Evaluating the score

Successful tooth preparation was evaluated based on clinical parameters, such as substance removal, amount of occlusal reduction, damage to adjacent teeth, finish line quality, preparation angle, and surface roughness. These criteria were used to determine the quality of the preparations.

The evaluation process involved determining the percentage of parameters that met the specified tolerance range as outlined in the prepCheck program manual. The score was based on the percentage of white regions in the undercut and margin quality parameters, gray regions in the surface quality parameter, and blue regions in the preparation taper, occlusal distance, and preparation type parameters.

The PrepCheck Report was used to evaluate the students' performance and generate a score out of 100. The score was calculated based on the percentage of parameters falling within the specified tolerance range for each parameter, and

the total score was determined by averaging the percentages of all six parameters. The weightage of each parameter was also considered in the calculation, with the undercut, preparation taper, occlusal distance, preparation type, margin quality, and surface quality assigned weightages of 20%, 20%, 20%, 20%, 10%, and 10%, respectively. The traditional and digital assessments were conducted separately to avoid any potential bias.

2.2 Statistical Analysis

The SPSS 19.0 software package was utilized to analyze the data gathered in the study. Continuous variables were analyzed using descriptive statistics, such as mean, standard deviation, median, minimum and maximum values. To compare traditional and digital measurements on non-normal data sets, a Shapiro-Wilk normality test was performed on the collected data sets. The test results revealed that the data sets had non-normal distributions ($p< 0.05$). Therefore, the Wilcoxon test was used for comparison.

3. Results

The analysis of the study data demonstrated that there were no significant differences in the measurements of undercut and preparation type for tooth 27 between the traditional and digital techniques used. However, significant differences were observed in other parameters ($p<0.05$) (Figure 2).

In the case of tooth 21, there was no notable variation between the traditional and digital methods used for measuring occlusal distance, while significant differences were observed in other parameters ($p<0.05$) (Figure 3).

4. Discussion

The preclinical curriculum was enhanced with the integration of digital dentistry through training modules that complemented the existing traditional teaching methods. The implementation of computer-assisted learning (CAL) systems enabled flexibility in meeting the individual needs of the students. Margaryan *et al*. (2011), emphasized the importance of involving students in the teaching process and accommodating their preferred learning styles to maximize the educational success [17]. As such, the training modules were assessed using a standard survey methodology in the field of dentistry. In this study, the effectiveness of traditional faculty feedback was compared with that of the PrepCheck system to evaluate their relative efficacy. The selection of the program was based on its superiority compared to other digital assessment methods and its user-friendly interface. Participants had the option to repeat preparations as many times as needed and receive feedback from either faculty staff or digital validation systems exclusively. The evaluation type did not impact the participants' performance. Additionally, digital preparation assistant systems were found to be just as effective as traditional glance and grade methods [18]. The study utilized a widely recognized quality criterion of ±10% deviation, with the goal of achieving an optimal allowable value and establishing a minimum pass grade of 60% (19,20). Results indicate that the digital assessment method for preclinical undergraduate students was numerically equivalent to the conventional method. The lack of a significant difference may be due to the presence of a standard deviation of 10%.

The most effective approach to dental education, rather than relying solely on traditional or digital approaches, it is recommended to use a combination of both. Digital systems provide objective feedback that can help beginners identify their mistakes and improve their skills, while traditional teaching methods provide valuable guidance and support. By incorporating digital systems into free practice sessions, students can work independently to improve their preparation skills and become more efficient in their learning. This can ultimately save time and reduce frustration for both students and faculty members. In addition, free practice can be a useful way to prepare for exams and ensure that students are well-prepared for their future careers in dentistry.

While digital evaluation has many benefits, it has one major drawback: the lack of hands-on support and in-person feedback. Only experienced faculty staff can provide constructive criticism and meaningful guidance on proper dental equipment handling, manual dexterity and hand-eye coordination, finger rest, tactile drilling, and workplace ergonomics. Live demonstrations and step-by-step instructions are provided at the workplace to help students understand how errors can happen. Due to their insufficient practical experience, dental beginners had difficulty estimating exact values.

The study's primary hypothesis was mostly rejected, as there was no clear connection between conventional and digital assessment, except for the undercut and preparation type for tooth 27, and occlusal distance measurement of tooth 21. The second hypothesis was partially disproved due to the lack of association between traditional and digital assessment, which brings into question the assessment validity of the prepCheck software. When it comes to the effectiveness of computer-aided, self-instructional programs in dental education, a systematic review found mixed outcomes. While some studies did not find any difference between CAL and other learning strategies, others showed a significant benefit to CAL [21]. The study results show that the correlation between the overall agreement score and some criteria was significant only in instances and was not particularly strong. It is important to note that specific criteria were not assessed in this study. If we consider the time frame of this research, it's possible that it reflects a learning effect for those involved in the scanning and grading process. However, we should also acknowledge that these teeth have different locations, being both anterior and posterior. This suggests that further investigation could explore whether there is a system bias for certain types of preparations. The use of digital dental systems facilitated the acquisition of technical skills related to precise crown reduction, preparation type and surfaces roughness for beginners during ceramic crown preparation, leading to better test outcomes.

Gratton *et al*. (2016), investigated the effects of adding E4D Compare and CEREC prepCheck systems into the preclinical fixed prosthesis course curriculum. The study evaluated the technical and self-evaluation skills of students, as well as their visual and digital assessment scores. The use of digital technology did not have a significant impact on students' skills, and there was a moderate correlation between faculty and digital assessment scores in only two cases [22]. In our study we also found no significant difference between the traditional teaching method and the digital crown preparation technology regarding students' self-assessment and visual evaluation scores. The use of digital technology did not negatively affect students' skills in these areas, as suggested by the significant correlations between visual and digital assessment scores.

According to the results of the study conducted by Schlenz *et al*. (2020), students showed a positive attitude towards the integration of digital dentistry into the preclinical curriculum.

However, challenges with CAL systems were reported, and most students preferred evaluation by dental instructors. Despite this, CAL methods can be used as a supplementary teaching method alongside traditional approaches for teaching manual skills. They concluded that the use of CAL approaches in dental education does not eliminate the role of dental instructors; instead, it serves as a supplementary teaching method alongside traditional manual skills training [15].

Gratton *et al.*(2017), raised concerns about the moderate correlation between faculty evaluation and digital systems, noting that digital systems may calculate deviations from the specified preparation that lack clinical relevance. They suggested that experienced dentists may provide more appropriate feedback. Additionally, faculty feedback was found to be faster and more valuable to students, as faculty members ultimately perform the final evaluation. Furthermore, the effectiveness of the systems varied based on the user's skills, experience with the system, and technical support [23]. The efficacy of the digital evaluation software would likely improve with a more favourable student-scanner ratio. Moreover, the lack of incentive for students to use the technology as a graded component may have impacted the results. The results may suggest that only a limited number of faculty members were able to effectively utilize the prepCheck software during the courses.

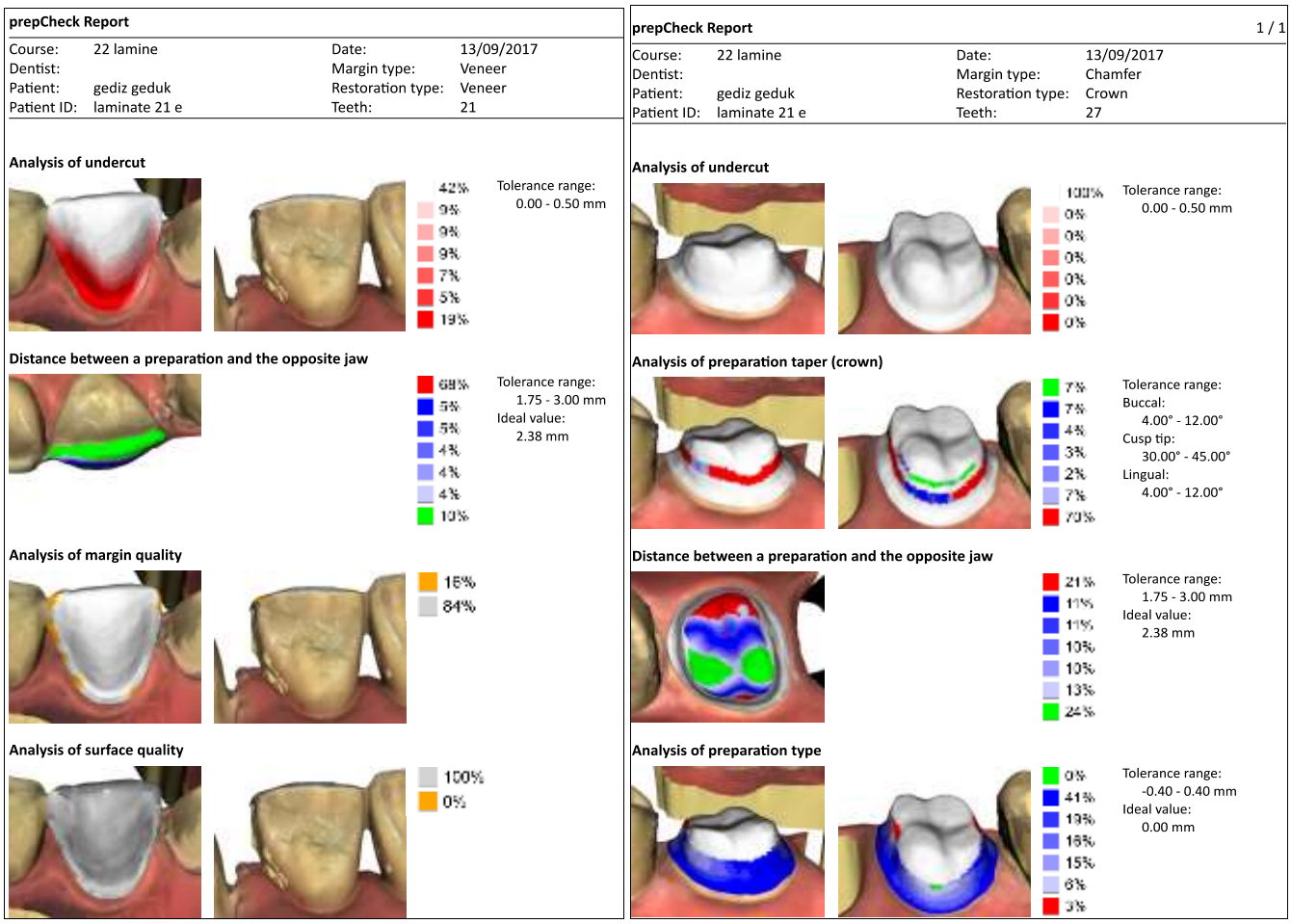

Fig 1: An illustration of a PrepCheck report.

Table 1: The values for tooth parameters in the traditional and digital evaluations of tooth 27.

	Undercut	Taper	Occlusal distance	Preparation type	Margin	Surface
Z	-1,841b	-2,023c	-2,023c	-1,753b	-2,023b	-2,032b
p-value	0,066	0,043	0,043	0,080	0,043	0,042

Table 3: The values for tooth parameters in the traditional and digital evaluations of tooth 21.

	Undercut	Occlusal distance	Margin	Surface
Z	-2,023b	-1,214c	-2,023b	-2,032b
p-value	0,043	0,225	0,043	0,042

Stoilov *et al.* (2021), found no significant difference in examination performance between the use of digital, PrepCheck and Dental Teacher software, and traditional methods. However, students preferred practicing with digital technology and sought direct feedback from faculty rather than relying solely on digital validation systems. The study found that while the use of digital technology did not significantly impact examination performance, students preferred a combination of both digital and traditional methods for effective learning, with faculty feedback being highly valued [10]. Cardoso *et al.* (2006) [24] evaluated pre-clinical students' technical proficiency using KaVo Prep Assistant for crown preparations. The study found that while digital assessment provided valuable insights, it may be less

sensitive than visual assessment, as the standard deviation was higher. The authors recommended examining more areas to increase accuracy and directly analyzing the amount of axial reduction instead of trying to replicate an ideal preparation. They also suggested that requiring students to copy a predetermined preparation may not be appropriate for this assessment [24]. Our study utilized a parameter-based comparison method, which was an advantage compared to the use of a master model in Cardoso *et al*.'s study. Additionally, the prepCheck software is not limited to use with specific dental models like KaVo Pre-passistant and does not require the selection of specific points or lines for evaluation. The use of digital technology in dental education can enhance teaching and evaluation methods, but the successful integration into the curriculum requires the involvement of dental students and faculty instructors. Recognizing the potential benefits of digital technology in dental education is crucial for improving the quality of dental training.

Hamil *et al*.'s (2014) [25] study showed that while the E4D Compare software had positive feedback from students, it was not sufficient in evaluating essential features of crown preparation such as margin roughness and undercut areas. Students believed that faculty feedback was necessary for a comprehensive evaluation of preparation success [25]. In contrast, our study utilized the prepCheck program for comparison purposes, which accounted for all necessary parameters and provided useful graphs for evaluation. This allowed for a thorough assessment, despite the limitations of the E4D Compare program.

Another study conducted by Park *et al*. (2017) [26], indicated that in pre-clinical dental education, digital methods such as PrepCheck have been identified as beneficial. The tool satisfies the needs of technology-oriented students, overcomes disparities in learning preferences, and fosters the development of self-evaluation skills in pre-clinical dental students [26]. It is important to note that the criteria for selecting participants in our study excluded any prior experience with preparation. Therefore, it is not surprising that students sought guidance from faculty staff more frequently. Based on the results, it can be concluded that the prepCheck taper and undercut tools were beneficial for students during their preclinical exercise. The study found a association between students' preclinical performance and their perceptions of the software, with those who performed worse considering the software to be more helpful.

The study has certain limitations that need to be acknowledged while interpreting the results. These limitations include a requirement for additional hardware, limited sample size, the exclusion of other digital assessment programs, and limited time availability. Additionally, there are some deficiencies in the prepCheck program, which may be addressed in the future. Therefore, caution is recommended when applying the findings, and further research is necessary to improve digital assessment methodologies.

Conclusion

Our research on the effectiveness of digital education programs in dental education showed that there was little agreement between digital and traditional evaluations.

1. The only parameter that showed no correlation between the two methods for tooth 27 was preparation type and undercut ($p<0.05$).
2. The evaluation of tooth 21 demonstrated no significant differences of occlusal distance wile using traditional and digital methods ($p<0.05$).
3. Our study found that modifications to the scoring formula in either digital or traditional evaluation methods could significantly impact the results upon reevaluation, which is an expected outcome under varying circumstances and timelines.

Acknowledgments

The study was conducted in accordance with the Declaration of Helsinki, and all students gave their informed consent for inclusion before they participated in the study.

Conflict of Interest

Not available.

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References

1. Wong ML, Lee TWO, Allen PF, Foong K. Dental education in Singapore: A journey of 90 years and beyond. The Asia Pacific Scholar 2020;5:3-7.
2. Rekow ED. Digital dentistry: a comprehensive reference and preview of the future. 1st ed. Surrey: Quintessence Publishing Company Limited; c2018.
3. Beuer F, Schweiger J, Edelhoff D. Digital dentistry: an overview of recent developments for CAD/CAM generated restorations. Br Dent J. 2008;204:505-511. https://doi.org/10.1038/sj.bdj.2008.350.
4. Liu L, Li J, Yuan S, *et al*. Evaluating the effectiveness of a preclinical practice of tooth preparation using digital training system: A randomised controlled trial. Eur J Dent Educ. 2018;22(4):e679-e686. doi:10.1111/eje.12378.
5. van Noort R. The future of dental devices is digital. Dent Mater. 2012;28:3-12.
6. Lebuis A, Lai B, Emami E, Feine JS. New technologies in health care. Part 1: a moral and ethical predicament. J Can Dent Assoc. 2008;74:631-635.
7. Flores-Mir C, Palmer NG, Northcott HC, Huston C, Major PW. Computer and Internet usage by Canadian dentists. J Can Dent Assoc. 2006;72:145.
8. Rosenberg, H.; Grad, H.A.; Matear, D.W. The Effectiveness of Computer-Aided, Self-Instructional Programs in Dental Education: A Systematic Review of the Literature. J. Dent. Educ. 2003, 67, 524–532.
9. Duta, M.; Amariei, C.I.; Bogdan, C.M.; Popovivi, D.M.; Ionescu, N.; Nuca, C.I. An overview of virtual and augmented reality in dental education. Oral Health Dent. Manag. 2011, 10, 42–49.
10. Stoilov M, Trebess L, Klemmer M, Stark H, Enkling N, Kraus D. Comparison of Digital Self-Assessment Systems and Faculty Feedback for Tooth Preparation in a Preclinical Simulation. Int J Environ Res Public Health. 2021;18(24):13218. Published 2021 Dec 15. doi:10.3390/ijerph182413218.
11. Sadid-Zadeh R, D'Angelo EH, Gambacorta J. Comparing feedback from faculty interactions and virtual assessment software in the development of psychomotor skills in preclinical fixed prosthodontics. Clin Exp Dent Res. 2018;4(5):189–95.
12. Cardoso J, Barbosa C, Fernandes S, Silva C, Pinho A. Reducing subjectivity in the evaluation of pre-clinical dental preparations for fixed prosthodontics using the Kavo PrepAssistant®. Eur J Dent Educ. 2006;10(3):149-56.

13. Lenherr P, Marinello CP. prepCheck computergestützte objektive Beurteilung von Zahnpräparationen im Simulationslabor. Swiss Dent J. 2014;124(10):1085-92.
14. Renne WG, McGill ST, Mennito AS, Wolf BJ, Marlow NM, Shaftman S, *et al*. E4D compare software: an alternative to faculty grading in dental education. J Dent Educ. 2013;77(2):168-75.
15. Schlenz MA, Michel K, Wegner K, Schmidt A, Rehmann P, Wöstmann B. Undergraduate dental students' perspective on the implementation of digital dentistry in the preclinical curriculum: a questionnaire survey. BMC Oral Health. 2020;20(1):78. Published 2020 Mar 18. doi:10.1186/s12903-020-01071-0.
16. Sahinbas A, Demir E, Eskitascioglu G. Dis Hekimligi Egitiminde Dijital Olcme ve Degerlendirme. Turkiye Klinikleri J Prosthodont-Special Topics. 2015;1(1):37-44.
17. Margaryan A, Littlejohn A, Vojt G. Are digital natives a myth or reality? University students' use of digital technologies. Comput Educ. 2011;56:429– 40. https://doi.org/10.1016/j.compedu.2010.09.004
18. Jasinevicius, T.R.; Landers, M.; Nelson, S.; Urbankova, A. An Evaluation of Two Dental Simulation Systems: Virtual Reality versus Contemporary Non-Computer-Assisted. J. Dent. Educ. 2004, 68, 1151–1162.
19. Tekian A, Norcini J. Overcome the 60% passing score and improve the quality of assessment. GMS Z Med Ausbild. 2015;32(4).
20. Harlen W, Deakin Crick R. A systematic review of the impact of summative assessment and tests on students' motivation for learning. Research evidence in education library. The Curriculum Journal. 2002.
21. Rosenberg H, Grad HA, Matear DW. The effectiveness of computer-aided, self-instructional programs in dental education: a systematic review of the literature. J Dent Educ 2003;67(5):524-32
22. Gratton D, Kwon S, Blanchette D, Aquilino S. Impact of digital tooth preparation evaluation technology on preclinical dental students' technical and self-evaluation skills. J Dent Educ. 2016;80(1):91-9.
23. Gratton D, Kwon S, Blanchette D, Aquilino S. Performance of two different digital evaluation systems used for assessing pre-clinical dental students' prosthodontic technical skills. Eur J Dent Educ. 2017;21(4):252-60.
24. Cardoso J, Barbosa C, Fernandes S, Silva C, Pinho A. Reducing subjectivity in the evaluation of pre-clinical dental preparations for fixed prosthodontics using the Kavo PrepAssistant®. Eur J Dent Educ. 2006;10(3):149-56.
25. Hamil LM, Mennito AS, Renné WG, Vuthiganon J. Dental students' opinions of preparation assessment with E4D compare software versus traditional methods. J Dent Educ. 2014;78(10):1424-31.
26. Park CF, Sheinbaum JM, Tamada Y, *et al*. Dental students's perceptions of digital assessment software for preclinical tooth preperation exercises. J Dent Educ. 2017;81:597-603.

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