

# Use of virtual reality in teaching dentistry: A pilot project

Carolina Dea Bruzamolín\* ; Eduarda Ravello Cardoso\*\* ; Stéffany dos Anjos Francisco\*\* ; Carlos Roberto Botelho-Filho\*\*\*; Marilisa Carneiro Leão Gabardo\*\*\*\*

\* PhD Professor, Undergraduate in Dentistry, Universidade Positivo

\*\* Undergraduate student in Dentistry, Universidade Positivo

\*\*\* Postgraduate student of Postgraduate Program in Dentistry, Universidade Positivo

\*\*\*\* PhD Professor, Postgraduate Program in Dentistry, Universidade Positivo

Received March 27, 2020. Approved September 23, 2020.

## ABSTRACT

The use of active methodologies in the teaching-learning process has been widespread in many teaching institutions, and dentistry is no exception. In addition to providing students with a more global view, it offers more individual autonomy and collective awareness, since more active work, with problems, is beneficial for their development. In view of this, this paper reports on the experience of producing a 360° video of a routine situation in dentistry: patient preparation and handwashing in the operating room. The material prepared is intended to serve as a tool for the student to be able to assist him/her in advance of subsequent practices, as this way he/she will have the possibility of being more ready, which seems to lead to favorable performances of some dental activities. The tool presented here is a new resource that can be combined with traditional teaching methods and its impact must be assessed.

**Descriptors:** Teaching Materials. Dentistry. Virtual Reality.

## 1 INTRODUCTION

In the middle of 1910, the Flexnerian model, which was adopted by training institutions, was widely disseminated at a time when teaching was unidirectional and centered on the teacher<sup>1</sup>. One of the main purposes of the current forms of instruction is to provide students with learning with an overall view, making them develop individual autonomy and

collective consciousness<sup>2-4</sup>. Increasingly, there is a need for changes in the learning process. This corresponds to differences with regard to the training process, but such a process is challenging<sup>5</sup>. Proof of this diversity is to be found, for example, in “schools that are in the 19th century, with teachers from the 20th century, training students for the 21st century world”<sup>6</sup>. A survey with reference to factors that

favor and compromise the quality of dental education revealed precisely, among the latter, the existence of traditional, old, and deficient curricular programs, that is, the existence of a deficit in terms of innovation<sup>7</sup>. There is also a notable conflict between those who defend traditional or innovative models<sup>8</sup>.

Active methodologies are practices that incite interest where students are included in the reasoning processes and bring new components to the theory; these had not been previously considered<sup>9</sup>. These methodologies use problematization as a learning vehicle in order to motivate, since the student, in the face of difficulties, starts to reflect on fundamental points for the promotion of their own development<sup>6,10</sup>. In addition, the development of active models allows the student to acquire a broader conception of their knowledge and, in the case of health professionals, go beyond the dimension focused on the absence of disease<sup>11</sup>. In this way, students are offered theoretical knowledge based on the observation of reality, which allows the theory to be learned with a practical connection<sup>5</sup>.

According to Cunha *et al.*<sup>12</sup>

*“[...] An innovative experience is a process located in a historical and social context that requires a break with academic procedures inspired by the positivist principles of modern science. Innovative movement in the micro-institution can be as important as the movement of the institutional whole.”*

In dentistry, there is a great possibility for the use of active methodologies, such as problematization<sup>13-15</sup>, blended learning<sup>16</sup>, projects<sup>17</sup> and more currently simulators<sup>18-21</sup>, with the potential to develop autonomy through learning. However, it is important to emphasize the paramount importance of maintaining the

quality of teaching, a fact that can be compromised due to a large number of students in the classroom<sup>22</sup>.

In the dental field, digital transformation is recognized as one of the main changes of the 21st century that can be used to face challenges in oral health<sup>23</sup>. In this context, virtual reality (VR) appears as a new possibility of connection, as three-dimensional reproductions closer to the user's reality allow students to break the screen barrier, providing for more natural contacts. In addition, the fact that virtual objects are brought to the user's physical space allows for more spontaneous and uncomplicated concrete interactions without the use of special equipment. For this reason, VR has been considered a tangible possibility that could be popularly used with the next generation, whether indoors or outdoors<sup>24</sup>. VR, specifically in the teaching area, has been used in pre-clinical dental training<sup>18,23,25,26</sup>, in implant dentistry<sup>27</sup>, and in maxillofacial surgery<sup>28</sup>.

The present experience report describes the development of a VR film in 360° as a way of using this instrument to help dentistry students.

## 2 EXPERIENCE REPORT

The present study is an experience report of a 360° video with a dental theme that can feasibly be watched with VR glasses.

First, the script for the film was planned by a dental surgeon, an assistant in oral health and an actor in order to represent a fictitious situation of preparation for the dental care of a patient in the surgical center of Universidade Positivo, located in Curitiba, Paraná.

A 360° camera (Samsung Gear®, Manaus, AM) was used, monitored by a specific application (VSDC Free Video Software, <http://www.videosoftdev.com/>). The camera was positioned with the aid of a tripod over the

dentist's head to simulate her vision and record the entire sequence, from entering the operating room and surgical handwashing (figure 1) to patient

preparation for surgery (figure 2). The video was recorded and made available to students (<https://www.youtube.com/watch?v=HWkQ-6u3j-I>).

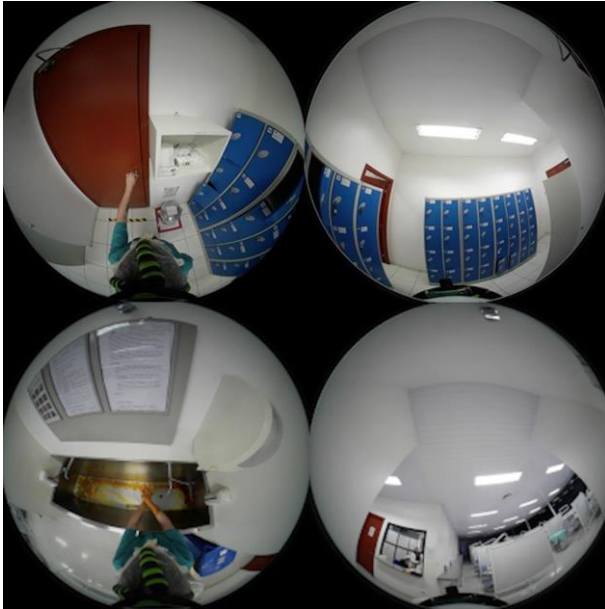


Figure 1. Image captured from the VR video showing the professional's entry into the operating room and surgical hand washing

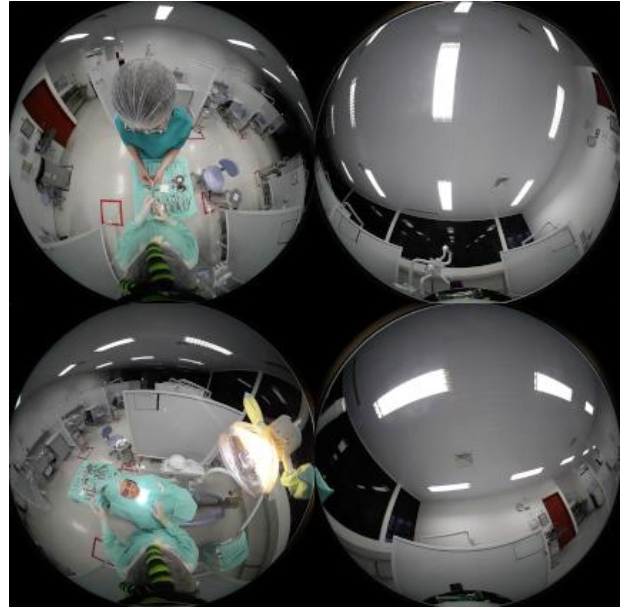


Figure 2. Image captured from the VR video showing the assembly of the operating table and the preparation of the patient for care

### 3 FINAL CONSIDERATIONS

The breaking of the “traditional” teaching model, marked by unidirectionality in the teacher–student relationship and by the fragmentation of people’s bodies and health, is becoming a reality in training institutions. This model is responsible for the training of professionals who have mastered the most diverse types of technologies, but who are little experienced in the subjective, cultural, and social dimensions of individuals, and is increasingly distant from the current model of organization of public health services in Brazil, as well as in view of the new behaviors expressed by the current generation<sup>11,29,30</sup>.

In contrast, one of the main purposes of current forms of instruction is to provide students

with broad and autonomous learning<sup>2-4</sup>. It is precisely these assumptions that informed the list of competencies and skills set out in the National Curricular Guidelines for dentistry courses<sup>31</sup>.

The unprecedented technological development in the current world has led to a real revolution and renewal of digital media, and dentistry is no exception<sup>23</sup>. This implies that there are new forms of interaction and acquisition of knowledge, which can be a bridge between the student and his/her academic life. Considering the difficulties sometimes presented in expanding their knowledge about dental care, the use of VR can lead to a better understanding of this routine. The present study, then, sought to present a methodological proposal, based on VR

technological resources, that provides a visualization prior to the first contact with the patient in a dental care situation.

In dentistry, VR use has been demonstrated in some areas<sup>18,23,25-28</sup>. However, 360° videos are still scarce. The inclusion of students in VR is relevant, as the use of this tool in the university environment has the potential to influence not only the future of interactive entertainment but also interactive training, education, and simulation<sup>32</sup>.

VR is an “advanced user interface” for accessing applications running on the computer, providing real-time visualization, movement, and user interaction. The sense of sight is often prevalent in VR applications, but the other senses, such as touch and hearing, can also be used to enrich the user experience<sup>33</sup>.

However, it is appropriate to consider the limitations of this method. A recent literature review revealed that computer simulation has positive results in operative dentistry, for example, but VR needs to be viewed with more caution<sup>20</sup>. Farronato *et al.*<sup>34</sup> also state that the validation of this entire educational process is still necessary. Joda *et al.*<sup>23</sup> note that technologies should be used in conjunction with human skills and qualities.

The use of interactive materials that combine books and applications, has been growing due to the combination of technology (whether in applications, games, or videos) that stimulates the search for concepts and the application of what is learned in practice. Among the limitations of this practice, it is important to emphasize that digital resources must be used in a correct and controlled manner, with the proper guidance and direction, in order for them to become an important tool and not a simple distractor<sup>32</sup>.

It has been suggested that a study be conducted to evaluate the use of these films in different scenarios as a way of learning and

integrating the student with the reality of the course and with the approximation of the practical experience of the dentistry course.

This study showed that VR video in 360° is a new resource that can be used in combination with traditional methods. Its ability to improve learning, decision-making, and resolvability remains to be assessed.

## RESUMO

### Uso de realidade virtual no ensino da Odontologia: um projeto piloto

O uso de metodologias ativas no processo de ensino-aprendizagem vem sendo amplamente difundido em muitas instituições de ensino e a Odontologia não foge desse contexto. Além de trazer aos estudantes uma visão mais global, oferece mais autonomia individual e consciência coletiva, uma vez que o trabalho mais ativo, com problematizações, é benéfico para o desenvolvimento dos mesmos. Frente a isso, aqui é relatada a experiência da produção de um vídeo em 360°, de uma situação rotineira em Odontologia: o preparo do paciente e a lavagem das mãos em centro cirúrgico. O material elaborado se propõe a servir como ferramenta para que o estudante possa assisti-lo previamente às práticas subsequentes, pois assim terá a possibilidade de estar mais adaptado, o que parece favorecer a execução de algumas atividades odontológicas. A ferramenta aqui apresentada é um recurso novo que pode ser combinado com métodos tradicionais de ensino e seu impacto deve ser avaliado.

**Descritores:** Materiais de Ensino. Odontologia. Realidade Virtual.

## REFERENCES

1. Gomes MPC, Ribeiro VMB, Monteiro DM, Leher EMT, Louzada RCR. O uso de metodologias ativas no ensino de graduação nas ciências sociais e da saúde – avaliação dos estudantes. *Ciênc Educ*. 2010; 16(1):181-98.
2. Lombroso P. Aprendizado e memória. *Rev Bras Psiquiatr*. 2004; 26(3):207-10.

3. Kenski VM. Aprendizagem mediada pela tecnologia. *Rev Diálogo Educ.* 2003; 4(10):47-56.
4. Mitre SM, Siqueira-Batista R, Girardi-de-Mendonça JM, Morais-Pinto NM, Meirelles CAB, Pinto-Porto CP, et al. Metodologias ativas de ensino-aprendizagem na formação profissional em saúde: debates atuais. *Ciêns Saúde Colet.* 2008; 13(Sup 2):2133-44.
5. Cyrino EG, Toralles-Pereira ML. Trabalhando com estratégias de ensino-aprendizado por descoberta na área da saúde: a problematização e a aprendizagem baseada em problemas. *Cad Saúde Pública.* 2004; 20(3):780-8.
6. Barbosa EF, Moura, DG. Metodologias ativas de aprendizagem na educação profissional e tecnológica. *B Tec Senac.* 2013; 39(2):48-67.
7. Medina PF, Bezerra TOC, Gouvêa CVD. Fatores favorecedores e comprometedores na qualidade acadêmica do ensino de Odontologia. *Ensino Re-Vista.* 2019; 26(2):590-614.
8. Secco LG, Pereira MLT. Concepções de qualidade de ensino dos coordenadores de graduação: uma análise dos cursos de odontologia do Estado de São Paulo. *Interface (Botucatu).* 2004; 8(15):313-30.
9. Diesel A, Baldez ALS, Martins SN. Os princípios das metodologias ativas de ensino: uma abordagem teórica. *Rev Themis.* 2017; 14(1):268-88.
10. Berbel NAN. As metodologias ativas e a promoção da autonomia de estudantes. *Semina Ciênc Soc Hum.* 2011;32(1):25-40.
11. Caldarelli PG. A importância da utilização de práticas de metodologias ativas de aprendizagem na formação superior de profissionais da saúde. *Rev Sustinere.* 2017; 5(1):175-8.
12. Cunha MI, Marsico HL, Borges FA, Tavares P. Inovações pedagógicas na formação inicial de professores. In: Fernandes CMB, Grillo M (Orgs). *Educação Superior: travessias e atravessamentos.* Canoas: Editora da ULBRA. 2001; p. 33-90.
13. Oliveira RG, Dias AL, Ferraz-Júnior AML, Porto FR, Hespanhol FL, Silva RHA, et al. Problematização como método ativo de ensino-aprendizagem em um curso de odontologia. *Rev ABENO.* 2015; 15(2):74-81.
14. Pinto ML, Mistro FZ, Uemera ST. Ensino baseado em problemas como prática pedagógica aplicada a alunos ingressantes no curso de Odontologia. *Rev ABENO.* 2016; 16(3):28-35.
15. Rocha JS, Dias GF, Campanha NH, Baldani MH. O uso da aprendizagem baseada em problemas na Odontologia: uma revisão crítica da literatura. *Rev ABENO.* 2016; 16(1):25-38.
16. Tomazinho PH, Chaves TMN, Fagundes FS, Gabardo MCL, Pizzatto E, Gonzaga CC, et al. Implementação e avaliação de um curso blended learning de Bioquímica para estudantes de Odontologia. *Rev ABENO.* 2018; 18(4):140-7.
17. Queiroz JRC, Oliveira MFJ, Souza DMC, Araújo ALLS, Fuscilla MAP. Aprendizagem por projeto e inovação tecnológica: união por competências. *Rev ABENO.* 2016; 16(2):2-6.
18. Liu L, Zhou R, Yuan S, Sun Z, Lu X, Li J, et al. Simulation training for ceramic crown preparation in the dental setting using a virtual educational system. *Eur J Dent Educ.* 2019; 11(1):1-24.
19. Morales-Vadillo R, Guevara-Canales JO, Flores-Lujpan VC, Robello-Malatto JM, Bazán-Asencios RH, Cava-Vergíu CE. Use of virtual reality as a learning environment in dentistry. *Gen Dent.* 2019; 67(4):21-7.
20. Nassar HM, Tekian A. Computer simulation and virtual reality in undergraduate operative and restorative dental education: a critical

- review, *J Dent Educ.* 2020; 1(1):1-18.
21. Vincent M, Joseph D, Amory C, Paoli N, Ambrosini P, Mortier E, et al. Contribution of haptic simulation to analogic training environment in restorative dentistry. *J Dent Educ.* 2019; 12(1):1-10.
22. Lage RH, Almeida SKTT, Vasconcelos GAN, Assaf AV, Robles FRP. Ensino e aprendizagem em Odontologia: Análise de sujeitos e práticas. *Rev Bras Educ Méd.* 2017; 41(1):22-9.
23. Joda T, Bornstein MM, Jung RE, Ferrari M, Waltimo T, Zitzmann NU. Recent trends and future direction of dental research in the digital era. *Int J Environ Res Public Health.* 2020; 17(6):1-8.
24. Moran JM. Ensino e aprendizagem inovadores com tecnologias. *Informática na Educação: Teoria e Prática.* 2000; 3(1):137-44.
25. Murbay S, Neelakantan P, Chang JWW, Yeung S. Evaluation of the introduction of a dental virtual simulator on the performance of undergraduate dental students in the pre-clinical operative dentistry course. *Eur J Dent Educ.* 2020; 24(1):5-16.
26. Serrano CM, Wesselink PR, Vervoom JM. First experiences with patient-centered training in virtual reality. *J Dent Educ.* 2020; 1(1):1-8.
27. Durham M, Engel B, Ferril T, Halford J, Singh TP, Gladwell M. Digitally augmented learning in implant dentistry. *Oral Maxillofac Surg Clin North Am.* 2019; 31(3):387-98.
28. Bartella AK, Kamal M, Scholl I, Schiffer S, Steegmann J, Ketelsen D, et al. Virtual reality in preoperative imaging in maxillofacial surgery: implementation of “the next level”? *Br J Oral Maxillofac Surg.* 2019; 57(7):644-8.
29. Ribeiro VMB. Discutindo o conceito de inovação curricular na formação dos profissionais de saúde: o longo caminho para as transformações no ensino médico. *Trab Educ Saúde.* 2005; 3(1):91-121.
30. Brant VMR, Brant A. Formação dos profissionais de saúde, o PSF e o SUS. In: Brasil. Ministério da Saúde. Secretaria de Gestão Participativa. Reorganizando o SUS na região. Brasília: Ministério da Saúde. 2004. p. 33-7.
31. Brasil. Conselho Nacional de Educação Superior. Resolução CNE/CES 3/ 2002, de 4 de março de 2002. Institui diretrizes curriculares nacionais do curso de graduação em Odontologia. Brasília: Diário Oficial da União. Seção 1. p.10
32. Zyda M. From visual simulation to virtual reality to games. *Computer.* 2005; 38(9):25-32.
33. Kirner C, Tori R. Realidade virtual: conceitos, tecnologias e tendências. São Paulo: Editora SENAC. 2004.
34. Farronato M, Maspero C, Lanteri V, Fama A, Ferrati F, Pettenuzzo A, et al. Current state of the art in the use of augmented reality in dentistry: a systematic review of the literature. *BMC Oral Health.* 2019;19(1):135.

**Correspondence to:**

e-mail: [marilisagabardo@gmail.com](mailto:marilisagabardo@gmail.com)

Marilisa Carneiro Leão Gabardo

Rua Prof. Pedro Viriato Parigot de Souza, 5300

81280-330 Curitiba/PR Brazil