

Undergraduate students as knowledge multipliers and facilitators in the teaching-learning process about a digital radiographic system

Rafaela Longaray Mazim*; Maximiliano Reidel*; Heraldo Luis Dias da Silveira**; Mariana Boessio Vizzotto***; Priscila Fernanda da Silveira Tiecher***; Nádia Assein Arús***

- * Undergraduate student, School of Dentistry, Federal University of Rio Grande do Sul
- ** Associate Professor, Department of Surgery and Orthopedics, School of Dentistry, Federal University of Rio Grande do Sul
- *** Adjunct Professor, Department of Surgery and Orthopedics, School of Dentistry, Federal University of Rio Grande do Sul

Received February 02, 2020. Approved May 16, 2020.

ABSTRACT

This report presents the five-step methodology adopted for the empowerment and training of professors and students for the use of a new intraoral radiograph digital system. It highlights the importance of undergraduate students as facilitators and multipliers in the teaching-learning process. Two students were selected to act as facilitators in the teaching-learning process and multipliers of knowledge regarding the radiographic system. These students, together with oral radiology professors, participated in meetings with the board and administrative technicians to define goals (step 1), organized teaching materials (step 2), developed 2-hour theoretical-practical activities for professors and all clinical students (step 3), followed the system implementation stage during one semester (step 04) and applied the evaluation of the system used (step 5), on the Dental Teaching Hospital. Students and professors from two clinical disciplines were chosen to experience the onset of this implementation. At the end of the semester, a survey was conducted to evaluate the usability of the radiographic system. Overall, 176 students and 12 professors participated in the theoretical-practical activity. During system implementation, 68 students and 34 professors experienced the new technology. The usability assessment according to students and professors was 73.35 and 79.37, respectively. The proposed digital system was implemented correctly. The experience of undergraduate students in the different stages of the project, problematization of the theme, accomplishment of their work in a collaborative manner, and the application of solutions developed by them contributed to the formation of professionals always open to critically change.

Descriptors: Dental Radiography. Digital Radiography. Teaching. Dentistry.

1 INTRODUCTION

Technological advancement presents different alternatives for radiology in healthcare. Digital intraoral radiographic systems, when compared to conventional film-based imaging, are more sensitive to radiation, which means that lower exposure doses are required to obtain images with the same diagnostic quality as conventional radiography¹.

In 2016, the School of Dentistry of the Federal University of Rio Grande do Sul (FO-UFRGS) opened the Dental Teaching Hospital (DTH), thus expanding its space to assist the population. In order to improve the services performed at DTH, the indirect intraoral radiograph digital system was acquired in the next year. The digital radiographic receptor is a phosphor plate similar to that of the analog system regarding size and flexibility, but it is read by a digital scanner, thus eliminating the need for chemical processing. This system saves professionals' time; the phosphor sensor is reusable, it allows adjusting the image after processing, and facilitates the storage and retrieval of images²⁻⁵ and communication between dentists³⁻⁵.

The implementation of the digital system meets the FO-UFRGS technological innovation process since the establishment of DTH. A challenge was posed to the area of Radiology: to make the transition from analog to digital system within the clinical environment of the hospital. Changing work routines requires the involvement of a whole community, including undergraduate students collaborating in the process, not only as users of the new system. Thus, this report of the undergraduate students' experience as multipliers of knowledge and as active participants in the implementation of the digital radiographic system in the FO-UFRGS community is justified.

2 MATERIALS AND METHODS

This study was approved by the Institutional

Review Board of Federal University of Rio Grande do Sul under number 3.519.274 (CAAE 15091919.0.0000.5347).

Based on this demand and with participation of the faculty board, professors, administrative technicians, and undergraduate and graduate students, strategies were developed to empower the entire faculty community and to determine new work routines involving changes in physical structure, image acquisition and visualization methodologies.

Selection and performance of the multiplier students

From the project "Digital Radiology in Dentistry: academic reinforcement and student follow-up in the application of new technology" (UFRGS Undergraduate Support Program Notice 03/2018)⁶, two undergraduate students were selected to act as support staff in the implementation of the digital system. The fellows were enrolled in the 6th semester of the day course and 7th semester of the night course. They participated, together with Oral Radiology professors, the institution's director and technicians, in the definition of goals, planning, accomplishment and evaluation of the project (figure 1). They also participated in the elaboration of the teaching material used for training, coordinated the practical activities and acted as facilitators in the DTH for the use of the digital system throughout the semester 2018/2.

Definition of Goals (step 1)

Those two students worked together, on two meetings with the Oral Radiology professors, faculty director and institution's technicians to define the following goals: (a) refreshing the subject and training of all 105 professors, (b) reinforcing and training of all students enrolled in clinical disciplines, and (c) implementation and follow-up of the digital

radiographic system use in the DTH for two clinical disciplines.

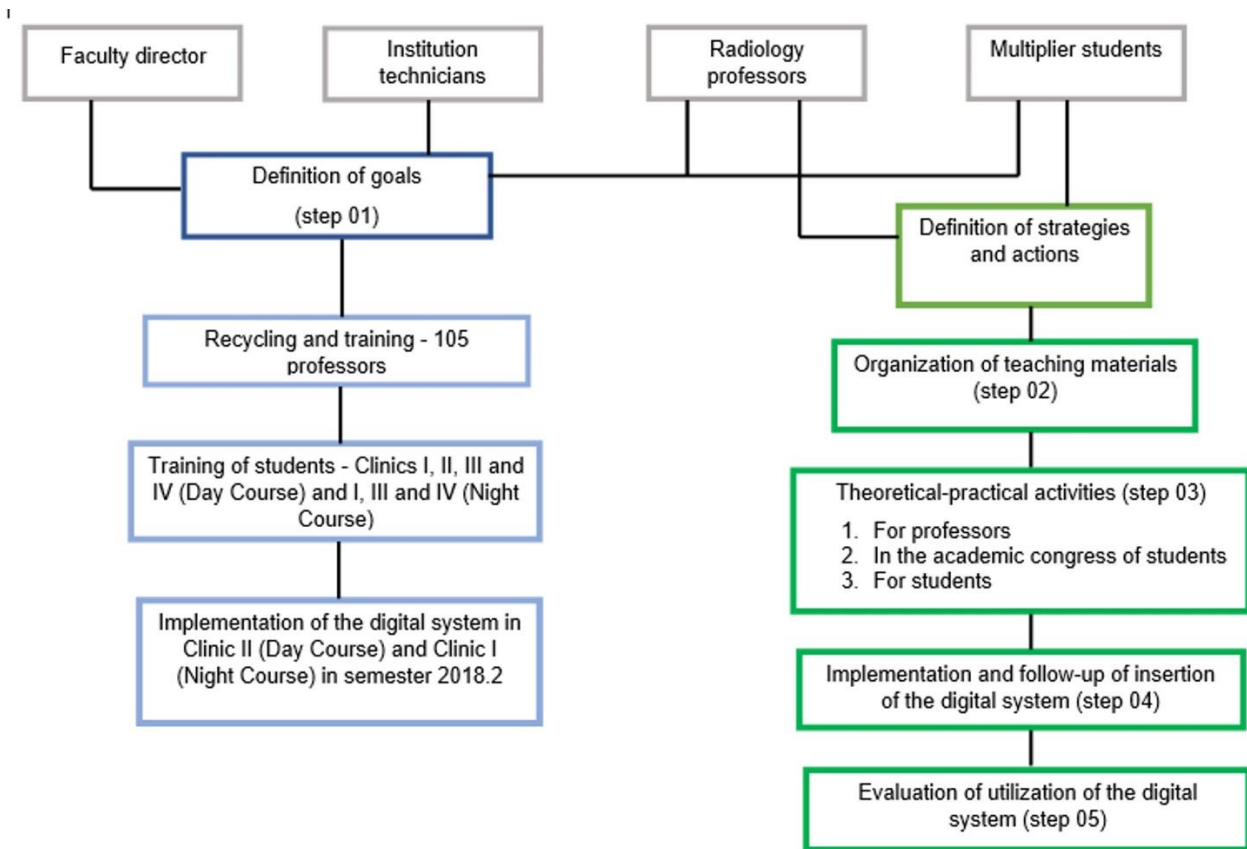


Figure 1. Flowchart of methodology for training of the academic community and implementation of the digital radiographic system at the DTH

Teaching material elaboration (step 2)

The programmed activity consisted of two theoretical and practical hours. For the theoretical part, the material prepared by Oral Radiology professors, together with the previously selected students, addressed the differences, advantages and disadvantages of the analog and digital systems, presentation of the new system and software installed in DTH, biosafety, use of sensor positioning devices, handling and protocol of plate processing, image post-processing and legislation related to radiographic images of patients. During the theoretical class, the space was open for

discussion and clarification. For the practical classes, it was planned that participants would obtain radiographs on simulators, read the receptor on the scanner, use the software, adjust and save the images for later viewing, always under the supervision of the students support team.

Theoretical-practical activities (step 3)

The development of activities was designed to be carried out in three phases. First, professors' refreshing and training through eight meetings offered at different moments to include a higher number of professors at their own schedule

availability. Then, the same course was offered at three different times during an academic congress of students. Additionally, two-hour classes were organized for each clinical discipline: day course Dental Clinics I, II, III and IV, and night course Dental Clinics I, III and V, one class at a time.

Digital system implementation and follow-up (step 4)

Aiming at a timely implementation to safely make the necessary adjustments, a gradual transition was planned, in which two classes were chosen to participate in this initial transition phase. Thus, professors and students linked to Dental Clinic II of the day course and Dental Clinic I of the night course participated in this stage.

The insertion of the digital system began by connecting it to a computer screen for acquisition, and another right next to it for viewing and

discussion of cases among students and professors. Two additional screens were placed at strategic DTH locations so that everyone could access the images without delay.

Evaluation of utilization of the digital system (step 5)

At the end of the semester, the usability of the digital system was evaluated by a survey, in which students and professors of the two clinical disciplines involved answered questions about effectiveness, efficiency and satisfaction. This survey used the SUS (System Usability Scale) tool⁷. On a range from 1 to 5, users agreed or disagreed with ten sentences, which covered several aspects, including support and training requirements, complexity and consistency of the system, the simplicity of use in that environment, and the users' opinion about the method (figure 2).

	Strongly Disagree			Strongly Agree	
	1	2	3	4	5
I think I would like to use this system often					
I think the system is unnecessarily complex					
I think the system was easy to use					
I would need help to use the system					
I think several functions of the system are very well integrated					
I think the system presents inconsistency					
I think people will learn how to use the system fast					
I think the system was complicated to use					
I felt reassured to use the system					
I needed to learn several new things before I was able to use the system					

Figure 2. Instrument applied to evaluate the utilization of the digital system (SUS Scale)

3 RESULTS

Participation in the training

The professors' exclusive training was attended by 12 faculty members. However, another 34 used the system during the semester, as they

were linked to the DTH clinics, adding up to 46 professors. During the activities of the academic congress, 19 undergraduate students from FO-UFRGS, a radiology technician and a graduated dental surgeon participated. The first

undergraduate classes participating in the theoretical-practical training were those that would effectively use the system in 2018/2: Clinic II day course and Clinic I night course. During the semester, the other clinic classes except for Clinic IV from the day course were trained, finishing this phase in December 2018, with 157 students trained.

Digital system implementation

Throughout the 2018/2 semester, the students linked to the project were near by the system and available to students and professors during attendance shifts to assist in handling the system. They were responsible for reiterating the work routine, receptor reading methodology and image manipulation for both colleagues and professors.

By the end of the semester, 380 patients had been treated with intraoral digital radiographs. The practical experience in DTH with the digital system, in 2018/2, was attended by 68 students and 34 professors who made up the student body and faculty of Clinics II – day course and Clinic I – night course, and they were invited to evaluate the usability of the digital system.

Usability evaluation of the digital system

The survey was answered by 38 students and 12 professors, which revealed SUS scale values of 73.35 and 79.37, respectively. The indices found represent good effectiveness, efficiency and user satisfaction with the system. The space for suggestions was used by 23 participants, with 9 positive comments with compliments and indicating the system as good and very good to use, three negative comments related to the inferior quality of one screen, and 11 suggestions such as the implementation of a higher number of systems and screens to speed up the workflow, and permanent assistance by a technician. From this total of comments, three highlighted the

importance of the multiplier students for the system implementation success.

4 DISCUSSION

Reporting this experience of transition to a digital radiographic system in a dental teaching institution is exceptionally relevant because little is known about this subject in the literature. The authors hope that it will serve as a basis, being improved and adapted by students and faculty from other educational institutions.

The demand to update the academic community concerning the digital system acquired by the institution brought a challenge to professors in the area of Oral Radiology. In addition to not reducing the daily tasks to participate in this project in full, there would be the motivational question of the community: how to make the professors and students interested in an activity that guides changes in the work routine, since the human being tends to be resistant to change? To solve these questions, it was decided to work with undergraduate students in the role of knowledge multipliers, from problematization of the topic.

The students selected to act as facilitators in the teaching-learning process participated in meetings with the board and professors, prior training of the digital system, further studies on the subject, development of strategies, as well as guiding practical activities and advising the professors and students at DTH. Thus, these two students experienced the stages of the problematization methodology: the observation of reality, the identification of key points of the problem, theorizing, hypotheses of solution and application to reality, i.e., they exercised the theory-practice relationship⁸. They were also able to experience cooperation for teamwork, sense of responsibility and belonging, as they worked with people from different spheres to identify and solve the problems and were responsible for the multiplication of knowledge.

The presence of DTH undergraduate students, who took responsibility for the digital system, allowed for peer interaction formed by an experienced individual and a novice, providing a collaborative, supportive activity in which, little by little, the ablest delegates control to the inexperienced⁹. This process occurs more easily from the stimulation of the student-student relationship, without fear, as they are in similar positions of age and cognitive development. The proximity of the actors also allows immediate feedback, which facilitates adjusting the process if necessary⁹. This working methodology applied in an environment formed by equals is believed to be more motivational when compared to that in which there may be hierarchy interpretation.

A concern of the fellows was their position in relation to professors of the Clinics, as in some situations they would be "teaching" their masters. However, the whole exercise of teamwork and participation in the stages of problematization methodology reassured these students to dialogue with the professors and clarify their doubts, in a relationship of partnership and respect.

The number of professors present in the training may be justified by the fact that some of them already work with the same system in Specialization courses or in their previous clinical experience. It is worth remembering that, in addition to the 12 enrolled in the activity, 34 professors actively participated in its use during the semester of insertion of the system in DTH.

In the initial planning, all classes that performed clinical care would undergo training to use the digital system. However, at the end of the semester, due to the calendar of radiology and class activities, Clinic IV (8th semester) from the day course did not perform the training in 2018/2. It should be noted that this class would no longer work at DTH, as the curriculum directs them to the extramural activities. Besides, students who showed interest were allowed to participate in the

activities during FO-UFRGS academic congress of students.

The choice of classes that were involved in the insertion of the digital system considered characteristics such as security and curriculum availability. It is justified to choose the students of Clinic II day course, because they have already cared for patients and have a little more experience in achieving radiographs in clinical practice. The choice of students of Clinic I night course was due to the class size - about 20 students - because they perform only one service per shift and have more professors available in proportion to the other classes. The other clinical disciplines began their activities in 2019.1, still under the supervision of monitors, fellows and administrative technicians.

From the survey answered by users of the digital system, it was possible to determine guidelines, make decisions and set priorities. Even presenting a result of satisfaction with the system, the most frequent suggestion was the desire to view the radiographic images on the tablets available in the dental chairs. Based on the identified demand, a software developed in 2019/1 has allowed the use of tablets to analyze the images individually in each service room.

5 CONCLUSIONS

The implementation of the FO-UFRGS digital system took place in an appropriate manner, and its objectives were contemplated. The participation of undergraduate students as knowledge multipliers and facilitators in the teaching-learning process was fundamental for the implementation of this project, since this considerably aided the communication and also, disseminated the sense of belonging among undergraduate students, thus all community members participated as active actors in the insertion of the digital system in DTH. The experience of undergraduates in different stages of the project, the collaborative accomplishment of

their work, and the application of solutions developed by them allows the formation of professionals always open to change in a critical way.

ACKNOWLEDGMENTS

The authors thank the Undergraduate Support Program of Federal University of Rio Grande do Sul that funded this project.

RESUMO

Estudantes de graduação como multiplicadores e facilitadores de conhecimento no processo de ensino-aprendizagem sobre sistema radiográfico digital

Este relato objetiva apresentar uma metodologia em cinco etapas adotada para capacitar a comunidade docente e discente no uso de um sistema radiográfico digital, e ressaltar a importância do estudante de graduação como facilitador e multiplicador no processo ensino-aprendizagem. Dois estudantes foram selecionados para atuarem como facilitadores neste processo e multiplicadores de conhecimento em relação ao sistema radiográfico. Esses acadêmicos, juntamente com os professores de radiologia, participaram de reuniões com a direção e técnicos administrativos para a definição dos objetivos (etapa 1), organizaram material didático (etapa 2), elaboraram atividades teórico-práticas de 2 horas para os alunos das clínicas e professores (etapa 3), acompanharam, por um semestre, a etapa de implementação do sistema no Hospital de Ensino Odontológico (etapa 4), e aplicaram a avaliação do uso do sistema digital (etapa 5). Duas disciplinas clínicas, seus alunos e professores, foram escolhidos para vivenciar a etapa de implementação. No término do semestre, foi realizada uma enquete que avaliou a usabilidade do sistema. Como resultado, 176 estudantes e 12 professores participaram das atividades teórico-práticas. Na etapa de implementação, participaram 68 discentes e 34 professores. A avaliação da usabilidade respondida pelos alunos e professores que utilizaram o sistema foi de 73,35 e 79,37, respectivamente. A implementação do sistema

digital proposta ocorreu de forma adequada. A vivência dos estudantes de graduação nas diferentes etapas do projeto, da problematização do tema, da execução do seu trabalho de forma colaborativa, e aplicação de soluções por eles elaboradas contribuiu na formação de profissionais sempre abertos às mudanças de maneira crítica.

Descritores: Radiografia Dentária. Radiografia Digital. Ensino. Odontologia.

REFERENCES

1. Hintze H, Wenzel A. Influence of the validation method on diagnostic accuracy for caries. A comparison of six digital and two conventional radiographic systems. *Dentomaxillofac Radiol.* 2002;31(1):44-9.
2. Eskandarloo A, Yousefi A, Soheili S, Ghazikhanloo K, Amini P, Mohammadpoor H. Evaluation of the effect of light and scanning time delay on the image quality of intraoral photostimulable phosphor plates. *Open Dent J.* 2017;11(2):690-700.
3. Yaghooti Khorasani MM, Ebrahimnejad H. Comparison of the accuracy of conventional and digital radiography in root canal working length determination: An invitro study. *J Dent Res Dent Clin Dent Prospects.* 2017;11(3):161-5.
4. Dehghani M, Barzegari R, Tabatabai H, Ghanea S. Diagnostic value of conventional and digital radiography for detection of cavitated and non-cavitated proximal caries. *J Dent (Tehran).* 2017;14(1):21-30.
5. Mesgarani A, Haghanifar S, Ehsani M, Yaghub SD, Bijani A. Accuracy of conventional and digital radiography in detecting external root resorption. *Iran Endod J.* 2014;9(4):241-5.
6. Mazim RL, Silveira PF, Santos THG. Implementação do sistema digital intrabucal na Faculdade de Odontologia da UFRGS: a participação ativa dos bolsistas PAG. XIV Salão de Ensino da UFRGS;

2018. [Cited Feb. 7, 2020]. Available at: <https://lume.ufrgs.br/handle/10183/192610>.
7. MeasuringU: Measuring usability with the System Usability Scale (SUS). [Cited Feb. 7, 2020]. Available at: <https://measuringu.com/sus/>.
8. Berbel NAN. A problematização e a aprendizagem baseada em problemas: diferentes termos ou diferentes caminhos? Interface (Botucatu). 1998; 2:139-54. A
9. Araújo VC, Araújo RCBF, Scheffer AMM. Discutindo aprendizagem e desenvolvimento da criança à luz do referencial histórico-cultural. Vertentes. 2009; 33:1-12.

Correspondence to:

Profa. Nádia Assein Arús
e-mail: nadia.arus@ufrgs.br
Rua Ramiro Barcelos, 2492
90035-003 Porto Alegre/RS Brazil