# Realistic Clinical Simulation: report of the experience of the realistic clinical simulation laboratory at FOUSP

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**Abstract** This report on the experience of realistic clinical simulation (RCS) is linked to the Realistic Clinical Simulation and Augmented Virtual Reality Laboratory, launched in June 2022 at the Faculty of Dentistry of the University of São Paulo (São Paulo). RCS is an active methodology that can significantly contribute to the education of dental students in all areas of dental knowledge. Its application must adhere to correct protocols for problem construction (briefing), the simulation itself, and the subsequent discussion (debriefing). This scenario represents both the present and the future of dental education. Indeed, its strategy enables the simulation of a multitude of clinical situations, for which the establishment of a specific environment (herein referred to as a "laboratory") is needed. The present work summarizes the basis of this simulation and the internal evaluation of its applicability and effectiveness. It is concluded that simulation is a facilitating strategy in the dental teaching-and-learning process. In fact, its role in this process will become increasingly important as far as other educational institutions adopt this resource and progressively exchange their experiences and assessments.
**Descriptors:** Teaching. Education, Dental. Patient Simulation.

**Simulación clínica realista: informe de la experiencia del laboratorio de simulación clínica realista de la FOUSP**

**Resumen** Se presenta la experiencia de simulación clínica realista (SCR) realizada en el Laboratorio de Simulación Clínica Realista y Realidad Virtual Aumentada de la Facultad de Odontología de la Universidad de São Paulo (inaugurado en junio de 2022). Esta metodología contribuye significativamente a la formación de los estudiantes de odontología en todas las áreas del conocimiento odontológico. Su aplicación debe someterse a protocolos correctos para la construcción del problema (briefing), simulación y posterior discusión (debriefing). Este escenario constituye la realidad presente y futura de la educación odontológica. De hecho, su estrategia permite simular una multiplicidad de situaciones clínicas. Para lograrlo, es necesario estructurar un entorno específico (aquí llamado "laboratorio"). Este trabajo resume los fundamentos de esta simulación y la evaluación interna de su aplicabilidad y efectividad inequívoca en nuestra Facultad. De hecho, la simulación es una estrategia facilitadora esencial en el proceso de enseñanza-aprendizaje de la Odontología, cuyo papel en este proceso debe ser cada vez más importante, a medida que otros centros de formación adopten este recurso e intercambien progresivamente sus experiencias y valoraciones.
**Descriptores:** Enseñanza; Educación Odontológica; Simulación de Paciente.

**Simulação Clínica Realística: relato da experiência do laboratório de simulação clínica realística da FOUSP**

**Resumo** Apresenta-se a experiência da simulação clínica realística (SCR) efetuada no Laboratório de Simulação Clínica Realística e de Realidade Virtual Aumentada da Faculdade de Odontologia da Universidade de São Paulo (inaugurado em junho de 2022). Essa metodologia contribui significativamente na formação do estudante de Odontologia em todas as áreas do conhecimento odontológico. Sua aplicação deve submeter-se a protocolos corretos construção do problema (*briefing*), a simulação e discussão posterior (*debriefing*). Este cenário constitui o presente e o futuro da realidade do ensino odontológico. De fato, sua estratégia possibilita a simulação de uma multiplicidade de situações clínicas. Para tal, impõe-se a estruturação de um ambiente específico (aqui denominado "laboratório"). Este trabalho resume os

fundamentos dessa simulação e a avaliação interna de sua aplicabilidade e inequívoca eficácia na nossa Faculdade. De fato, a simulação é uma estratégia facilitadora imprescindível no processo ensino-aprendizagem da Odontologia, cujo papel nesse processo deve delinear-se cada vez mais importante, na medida em que outros centros formadores forem adotando esse recurso e forem progressivamente intercambiando suas experiências e avaliações.

**Descritores:** Ensino. Educação em Odontologia. Simulação de Paciente.

## INTRODUCTION

The use of active methodologies in the teaching-learning process in healthcare courses is applied on occasion for student training, but seems to remain relatively unexplored in the field of Dentistry. As education based on scientific evidence and problem-solving skills, they are a valuable tool in the professional formation, enhancing student's capacity to address future challenges in their professional practices. In this context, realistic simulation is a teaching resource that creates real clinical scenarios, enabling enhanced clinical reasoning, decision-making, or skill acquisition in a controlled environment for undergraduate students[1].

Dental literature continuously discusses innovations in undergraduate dental education. However, realistic clinical simulation (RCS) has not yet been afforded its due prominence within the curriculum of Dentistry. Simulation is a set of methodological techniques used to enhance real-world experiences through planned scenarios, being one of its objectives to facilitate the acquisition of attitudinal skills by students in their clinical activities and enable them to perform these activities safely[2]. That active methodology performs simulated environments, under the observation of the professors, with student-centered learning in a safe environment (that is to say, without the presence of real, but fictional patients)[3]. As a methodology, clinical simulation replicates a clinical situation and environment to allow students experience real environments for their learning, skill acquisition, and knowledge. The spaces and simulators are essential to achieve these objectives. While internationally used in various healthcare courses, this strategy is relatively recent in Brazil[4,5].

Studies have shown that simulation training can help students to "integrate the whole," to enhance their theoretical understanding, and to improve their ability to assess clinical situations with patients[6-11]. One of those conducted a simulation study based on the design standards developed by the International Association for Clinical Simulation and Learning (INACSL). The aim of their study was to explore the experiences with students undergoing training alongside qualified nurses. It was observed that the participants experienced anxiety and nervousness, but the emotions they faced during the simulation contributed to enhancing the learning experience. Furthermore, they found simulation training to be a valuable and meaningful activity, as it brought to reality usual clinical healthcare situations into the academic practice and experience[12].

Developing attitudinal competencies in face of various situations that students will encounter requires an effective method for dental student training. Concurrently, critical thinking is fostered in all participants of the activity, as it is an active, dynamic, and engaging process, facilitating the participation of students, regardless of their personal aptitudes. Simulation involves students in the learning process, both those actively participating as well as those observing and taking notes on what they witness[7,8].

It is well known that healthcare sciences are constantly evolving with advancements in all aspects of patient care, stemming from basic, translational, and clinical research. Training that fosters high-level cognitive function and confidence in the decision-making process is of paramount importance. The possibility of providing higher-quality patient care while reducing variation in healthcare delivery is the most significant reason for implementing clinical simulations in healthcare-related courses. This is so because studies have shown shortcomings in healthcare improvement and indications that residency training, which would also be influenced by simulation, has a significant impact on the future performance of healthcare professionals[13].

The importance of simulation-based education extends beyond the use of simulator manikins, as seen in other healthcare fields like Medicine and Nursing. It primarily involves the integration of clinical scenarios, which is of utmost importance in the clinical context of teaching settings. This is because a single skill or task teaches only its individual components, sometimes leading to a deficiency in critical clinical thinking skills among students[14].

By creating hypothetical clinical cases, the students are brought closer to their future reality besides integrating theoretical and practical learning, allowing for the repetition of scenarios countless times. It is a safe way to instill principles and practices without involving real patients, thereby minimizing or even preventing errors in future real clinical activities. Simulation can be applied in all dental specialties without exception, and in multidisciplinary situations, being its impact immeasurable[10,11].

It's worth emphasizing that visual stimuli are essential for learning, as they arouse interest and can assist students in retaining content more effectively. Furthermore, the use of scenarios and images facilitates the memorization of key concepts that students must be able to apply in real-life contexts[14].

Some authors demonstrated the effectiveness and necessity of creating a new learning environment with a specific curriculum-related context, as it helps prepare students for the external reality and trains them for the challenges, they will face in their professional activity[15].

Situational simulation in healthcare education has proven to be a highly effective learning strategy, and implementing this teaching approach before actual clinical situations provides an opportunity to develop confidence and the ability to handle various scenarios. Clinical situations are constantly evolving, which can lead to insecurity, frustration, and anxiety among professionals.

Hence, the objective of this study is to explore the merits of integrating realistic simulation experiences into undergraduate dental programs[15,16].

## EXPERIENCE REPORT

The establishment of simulation laboratories in Dentistry programs is essential to create the appropriate environment for the application of this teaching strategy and to foster student attitudes. Simulations cannot be conducted in the skills laboratories that have existed since the early stages of Dentistry programs, as their focus is on developing skills in areas such as Restorative Dentistry, Endodontics, and Prosthodontics, as examples. These skills are essential for the psychomotor development of our students through the use of appropriate manikins for each area. However, they do not cultivate critical and logical clinical reasoning, attitudes towards clinical cases themselves, or handling unexpected situations during patient care.

Pain, patient personality, different reactions to the same situations, fear of needles, surgeries, root canal treatment, professional-patient relationship insecurities with their natural transferences and counter transferences, and ethical conduct can be deeply explored in the clinical-realistic simulation laboratory (CRSL). Despite experiences with CRSL in dental emergency situations dating back to 2009, it was only in 2021 that the opportunity arose to establish the Clinical Realistic Simulation and Virtual and Augmented Reality Laboratory in the Department of Maxillofacial Surgery, Prosthodontics, and Traumatology at the School of Dentistry of the University of São Paulo (USP). This laboratory was equipped with all the specific requirements necessary for this purpose.

Amidst the pandemic, simulation protocols were initiated, and since 2021, they have been used in the fields of Dental Anesthesia, Dental Surgery, Maxillofacial Traumatology, and Endodontics, as well as in various scenarios simulating medical emergencies in dental settings. Multi-disciplinary clinical cases were also developed, requiring integrated reasoning from students, including knowledge from basic areas.

The laboratory comprises four environments: a simulation room, a fully equipped dental office with a multidirectional microphone, one mirrored wall, and a completely transparent glass entrance. During simulations, students make decisions independently after participating in a briefing that provides basic information about the clinical case to be

simulated (Figures 1 and 2). The briefing takes place in an internal room within the department where the laboratory is located, specifically designed for this activity.



**Figure 1.** Simulation Laboratory - detail of the glass that separates the rooms and does not allow those in the service room to see the students who are watching. The room where the chairs are is the observation and debriefing room.



**Figure 2.** Room in which students take action after being instructed in the activity to be carried out.

Next to this simulated dental office, there is a mini auditorium (Figures 1 and 3) where students observe the simulation room through the mirrored glass and can hear all the dialogues taking place. Furthermore, these students are using a checklist specially prepared by the professors in the field, aligned with the intended simulation objectives. An area for the instructor to monitor the simulation, equipped with a computer capable of transmitting images and sounds to the television in the mini-auditorium and sound controls, is located adjacent to the simulation room. A space for virtual simulation (involving virtual and augmented reality) completes the laboratory area.
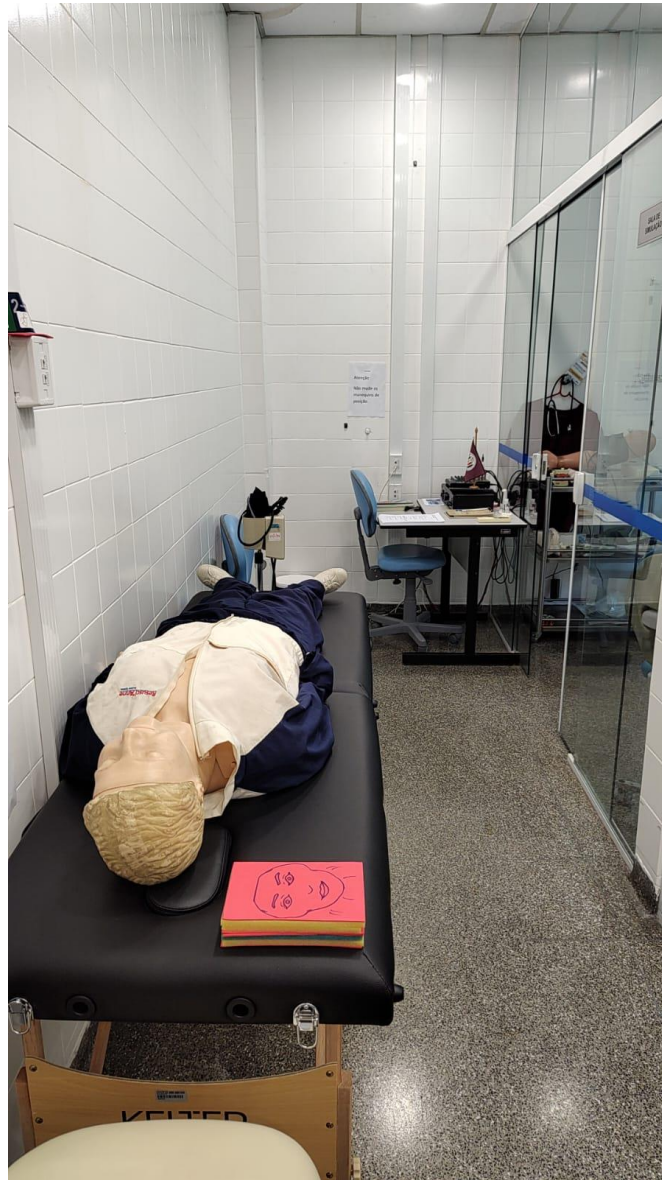


**Figure 3.** Access aisle to the simulation and observation and debriefing rooms with manikins for emergencies simulation.

Following the simulation, which typically lasts for about 10 minutes, all students participate in a debriefing session: a collective reflection on the experience, with minimal intervention from the instructors. This debriefing session lasts approximately 50 minutes. During this activity, students work on a clinical case that is similar to real-life scenarios but in a controlled environment. They learn from their mistakes or learn how to avoid making them. The simulation can be repeated as many times as necessary.

In parallel, instructors must engage with the simulation method to become accustomed to teaching with simulation and possess clinical experience to guide ideas and discussions toward the intended objectives. (Figure 4).

| Time applied | Designation | Function and prepare |
|---|---|---|
| Evolves according to the commitment of each teacher | Faculty Preparation | - understand what SCR is about<br>- write clinical cases<br>- train students as actors |
| 5 to 10 minutes | Briefing | - basic prior information about the clinical case to be simulated (students are free to improvise as they deem appropriate to the case) |
| 5 to 10 minutes | SCR | - presentation of the case studied by trained students |
| 1 hour to 1h and a half | Debriefing | - stage of discussions about the clinical case presented<br>- it will be so much richer as the teacher was clear about the skills to be built<br>- can involve 2 or 3 teachers who contribute with complimentary themes |

**Figure 4.** Stages of preparation and application of the Clinical-Realistic Simulation (SCR).

By adopting this strategy, it is foreseeable that in a few years, a culture of dental education through simulation will be established. Simulation does not replace traditional teaching but uniquely complements it. There is a need to include simulation in the curriculum at all points in the course where critical clinical reasoning by students is required.

The complexity of simulated cases can vary based on pedagogical objectives. In other words, even during clinical activities, students can always participate in simulated situations that enhance their clinical knowledge and confidence in patient care. This requires detailed case development in line with the intended objectives. The "patient" can be a manikin or a simulated individual. In the experiments conducted in the presented laboratory, cases typically begin with a student who is prepared to assume the role of the patient. This simulated patient, often a student-actor volunteering for the role, also learns a great deal from this activity. Among the students who participate, there is a unanimous perception that the experience is difficult, profound, that it produces doubts, uncertainties, and tension, even knowing that it is a simulated simulation. Having to make decisions causes insecurity and stress. The words of a participating student sum up this experience well: "I was part of the first class in the simulation laboratory at FOUSP and I can guarantee that my experience was fantastic" (published with prior authorization). When the simulation is carried out, one is faced with routine clinical situations that cannot be resolved simply and immediately. This is the best time to learn. There you can observe errors for continuous improvement, without exposing the patient or inadvertently exposing yourself. (Testimony from undergraduate student Julia Puglia, in the last year of her Dentistry course at FOUSP). There is a clear perception of the increase in trust that is acquired by the strategy used[3]. However, there are still challenges to overcome, including the shyness of students who may avoid participating in the simulation room. Among those who do participate in the simulation room, there is a unanimous perception that the experience is challenging, profound, generates doubts, uncertainties, and tension, even though it is known to be a simulation. It is apparent that the students have to make decisions through several levels of insecurity and stress. It is clear that the strategy used enhances confidence among participants.

## FINAL CONSIDERATIONS

Taking into consideration that all forms of virtual reality-based education are still in their early stages in Dentistry, and after reflecting on and observing the relevant literature, it is proposed that this approach should become a part of the guidelines for dental education.

The virtual environment should be interactive, pedagogical, available on multiple platforms, stimulating, and student-focused. The development industry should understand that Dentistry encompasses various complex and distinct areas, such as Surgery, Prosthodontics, Restorative Dentistry, Endodontics, and Stomatology, among others. Each of these areas requires careful study to construct simulated clinical cases that encompass their complexities and facilitate dynamic and enhanced learning through this strategy.

Thus, different interactive environments should be created across various areas of dental education. Students should be able to modify these variables and receive feedback during the simulation. Additionally, the technology should be easy for students to grasp and provide them with a sense of control over their decisions, presented in a youthful language. If the technology is too complex to handle, students are likely to lose focus and motivation. Simulations can and should include text, images, and other essential resources for understanding, keeping in mind that the internet already plays a significant role in students' personal searches for understanding concepts and protocols. The role of the teacher is to provide students with solid and reliable foundations.

The technical strategy can be enriched, which is highly desirable, as well as the development of diagnostic reasoning, with problem-solving goals. Different software to be developed can guide students' learning toward both diagnostic and treatment proposals, asking for possible solutions. For example, should anesthetics be administered with or without a vasoconstrictor agent? Should the treatment involve removable or fixed prostheses? Esthetic parameters in Restorative Dentistry should align with patient expectations, considering socio-cultural aspects, biotypology, and psychological expectations, among others. Complaints of pain should be understood as either irreversible or reversible pulpitis. Gamification can be an excellent option in these cases and should be considered in the development of specific programs where applicable. Considering the rapid evolution of new technologies, it would be reasonable for the proposed project design to be updatable, with expectations of application during several years before technology changes or the need of new equipment acquisition.

The experience described at the Faculty of Dentistry of University of São Paulo among students and instructors has been definitely enriching. At the same time as we are prone to exchange experiences with all interested colleagues, we strongly recommend this topic to be considered by all Dental Education institutions. Undoubtedly, this methodology needs to be integrated into dental education because it fosters student reflection on their knowledge, including the ability to communicate professionally with patients and other attitudinal aspects. In this way, it can provide greater security for both students and patients. The different manikins available in the healthcare field, combined with digital resources that will become part of dental education, will enable the simulation of all possible clinical situations in a dedicated laboratory for Clinical Realistic Simulation (CRS).

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