

Simulation centers and pedagogical planning: Two sides of the same coin

Centros de simulação e projeto pedagógico: dois lados da mesma moeda

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ABSTRACT

AIMS: This article discusses the main issues related to the use and structuring of a simulation center, namely, logistics, use of resources and alignment between the pedagogical project and simulated activities.

METHODS: A narrative literature review, with search in Web of Science, PubMed, SciELO and Google Scholar databases, included articles published up to June 2017.

RESULTS: Medical simulation has been implemented in the health courses for training and assessment. Because of this implantation, many simulation centers have been created, involving a high cost for the construction as well as the maintenance. Many of the simulation centers have a low acceptance from teachers and students, letting them underused, especially when the methodology is not correctly implemented. The simulation centers will become important when they are aligned with the pedagogical planning. Planning a simulation center is a time-consuming task, which requires visiting another simulation center to avoid major adjustments afterwards. It is important to identify the target group and the usage of the simulation center on the pedagogical planning to define the number of users and the type of structure. Also, it is necessary to identify the type of simulators the simulation center will use. Faculty development and multiple disciplinary teams are required. The lack of faculty development is one of the reasons of the underuse of the simulation center. Besides faculty development, other ways of optimize the simulation center is research and partnership between medical school and hospital. Medical school will have funding opportunities and interaction with society. The hospital will qualify their employees and increase the safety of their patients. While conducting the budget, there is a need to consider all those points, since only the physical space and the simulators are not sufficient for a good simulation center.

CONCLUSIONS: The integration between education, research and assistance, and the alignment with the pedagogical project are of utmost importance for the use of simulation in healthcare, and essential for the development of new training and knowledge.

KEYWORDS: simulation; medical education; patient safety; curriculum; healthcare professional education.

RESUMO

OBSERVAÇÃO: a versão em português do artigo completo está disponível na mesma página eletrônica.

OBJETIVOS: Discutir as principais questões relacionadas ao uso e estruturação de um centro de simulação: logística, aproveitamento dos recursos e alinhamento entre o projeto pedagógico e as atividades simuladas.

MÉTODOS: Revisão narrativa da literatura, com busca nas bases de dados Web of Science, PubMed, SciELO e Google Scholar, incluiu artigos publicados até junho de 2017.

RESULTADOS: A simulação médica tem sido inserida nos cursos da área de saúde tanto para treinamento quanto para avaliação. Com isso, houve um grande aumento de centros de simulação, os quais envolvem um alto custo tanto para sua infraestrutura geral e especificidades como para manutenção. Muitas vezes os centros de simulação têm uma baixa aceitação docente e discente, tornando-os subutilizados, principalmente quando a metodologia não é implementada adequadamente. O método será mais valorizado quando houver um alinhamento entre o projeto pedagógico e as atividades simuladas. O planejamento de um centro de simulação é uma tarefa árdua que exige estudo prévio, conhecimento sobre o currículo institucional, orçamento e visitas a outros centros já existentes para evitar grandes ajustes posteriores que potencialmente são difíceis e onerosos. Para um melhor aproveitamento logístico, é necessário inicialmente identificar o público alvo e a inserção curricular do método, para definir a quantidade de participantes, tipos de salas e tipos de simuladores. A capacitação docente e o envolvimento multiprofissional são necessários para o bom funcionamento do centro de simulação, sendo que um dos principais motivos para a sua subutilização é a falta de capacitação docente. Além de capacitar os docentes, outras formas para utilizar os centros de simulação estão relacionadas à pesquisa e à parceria entre escolas de medicina e serviços hospitalares. Nessa parceria, as instituições de ensino ganham oportunidades de financiamento e interação com a sociedade, enquanto os hospitais ganham qualificação e aumentam a segurança de seus pacientes. Todas essas questões devem ser consideradas quando o estudo orçamentário é realizado, pois apenas o ambiente físico e os simuladores não são suficientes para o aproveitamento do ambiente simulado.

CONCLUSÕES: A integração entre educação, pesquisa e assistência, e o alinhamento com o projeto pedagógico, são de extrema importância para a utilização da simulação na área da saúde, e essenciais para o desenvolvimento de novos treinamentos e conhecimentos.

DESCRITORES: simulação; educação médica; segurança do paciente; currículo; educação em saúde.

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Abbreviations: OSCE, Objective Structured Clinical Examination; OSATS, Objective Structured Assessment of Technical Skill.

INTRODUCTION

Simulation, as an educational strategy, has been widely inserted in healthcare curricula and in professional qualifications in several areas and specializations as another active learning tool. Theoretically, simulation may be motivational, allowing the simultaneous training of communication, procedural skills and clinical reasoning. However, the difficulties to implement new pedagogic methodologies are known, and curriculum innovations should be accompanied by faculty development and contextualization to the reality of local practice.

Over the last decades, simulation centers have proliferated all over the world [1]. Besides involving high costs for their construction, those centers are oftentimes sub-utilized, which makes them costly and with low acceptance by teacher and students, especially when the methodology is not employed correctly. In this context, the utilization and valorization of the simulation centers will only occur when the simulation training is incorporated into the pedagogic project of the course. In addition, faculty development strategies towards the dissemination and implementation as well as cultural changes in which patients' safety assumes a paramount role in the context of healthcare education are essential.

Taking into account the growth of medical and healthcare undergraduate courses, as well as the growth of other simulation centers directed towards continued education, this narrative view aims at discussing the main issues related to the use and structuring of a simulation center: simulated training as a teaching strategy, simulated training insertion into the pedagogic project, logistics, and use of the simulation center.

SIMULATED TRAINING AS A TEACHING STRATEGY

Traditionally, clinical skills are trained in real scenarios of practice by means of the supervisor-apprentice model, in which the student watches the health professional performing various procedures. The mentor-apprenticeship model assumes that students acquire medical competences and skills over time when they are exposed to patients [2]. This model

often places the student in a passive situation, which may hinder learning. Moreover, evaluation methods in this context are fragile and there are few opportunities for students to deliberately practice tasks that have not been completely mastered yet. Due to the significant complexity of the actual clinical scenario, feedback may be less effective as it is unable to specify the competence on which the student must focus in order to give the next step towards *expertise* [2].

As technology advances (specifically simulators), training of various medical skills has become possible in simulated environments. Simulation training may be tailored according to the needs of each student, contemplating the concept of “next development zone” and allowing them to learn according to their own pace [2]. The use of simulators enables students to train their technical and non-technical skills in a safe way and in a controlled environment, without risks for real patients [3-5]. Simulation training allows not only the training of skills, but also internalization of procedural routines, team work, leadership and communication training.

The use of simulation in healthcare as an educational practice is already widely established, which contributes to the students' learning. Moreover, the systematic use of simulation training as a pedagogic practice, improves patient care by improving their safety, contributing for therapeutic planning and team work [6].

The use of simulation in healthcare may be used to teach technical, behavioral and clinical skills. Advanced simulation centers can reproduce many medical skills using simulators, simulated patients, virtual reality, and corpses. Technical skills usually focus on motor components of the skill, from the simplest such as checking blood pressure, to the most complex such as handling a transducer for ultrasonography or inserting a thoracic drain. Behavioral skills focus on competences such as team work and communication, among others. In case of clinical skills, the focus must be on clinical reasoning and integration of all mentioned skills.

In pre-clinical training, simulation can be used to teach primary medical skills such as cardiac massage, but also as an opportunity to integrate students' knowledge with their skills, such as, for instance, using ultrasonography simulators to teach anatomy [7, 8]. By preparing students for clinical training, simulation training can be used to internalize procedural routines that must be automated before the actual contact with patients, such as orotracheal intubation techniques or advanced cardiopulmonary reanimation. Several authors suggested that at least the motor skills should be trained outside the real environment [9, 10].

Simulation training can also represent an opportunity to prepare students for future emotional experiences, which is often neglected in the real practice scenario. Several studies have shown that simulation training can trigger emotional responses similar to real life practice experiences [11, 12].

Along the clinical training, especially in medical internship, simulation training help students to problematize team work, commutation with patients and their families, and situations of moral and ethical dilemmas. It can also provide an opportunity to students to learn with their mistakes and practice in complex cases. Recently, with the advance of 3D printers, surgical cases is practiced in advance [13-15]. Moreover, 3D printers can assist in the teaching of various aspects of medical training in both undergraduate and postgraduate medical training [16].

Simulation training help students to develop different competences, and when formally inserted in the curriculum, simulation training also promote better learning and, therefore, higher knowledge retention [4]. **Chart 1** presents a summary on types of simulation used in undergraduate and continued education.

Nowadays, we have a better understanding of how motivation can be a motor force of learning. Simulation training allows the planning of activities compatible with the students' level, increasing the difficulty level as students progress, which generates a feeling of competence. When simulation training is conciliated with the real life clinical scenario, students' competence increase, generating more autonomy, moving students from a peripheral area of medical work to the center of clinical assistance. Students are motivated by the felling of acting as doctors with confidence, without compromising the patient's safety.

INSERTION OF SIMULATED TRAINING INTO THE PEDAGOGIC PROJECT

Literature indicates that simulation trainings inserted into the curriculum help students to acquire their clinical skills [4]. The main component of the simulation training introduction into the curriculum should be the pedagogic planning. The number of students, the course phase in which the activities are inserted, the quantity of rooms necessary, the number

Chart 1. Summary of types of clinical simulation used in undergraduate and continued education.

Type of Simulation	Characteristics and Examples
Simulation with standardized patients	<ul style="list-style-type: none"> Usually performed with actors/patients or a trained team, usually at "simulated practices". <p><i>Examples: communication scenarios for bad news or neurological clinical cases in which actors provide more realist to the scenarios.</i></p>
High fidelity simulation	<ul style="list-style-type: none"> Requires an advanced simulator with spontaneous breathing and possibility of general procedures. This is not an absolute rule, it is usually employed in high complexity, advanced scenarios. <p><i>Examples: cardiorespiratory arrest, septic shock or polytraumatism.</i></p>
Hybrid simulation	<ul style="list-style-type: none"> It associates the standardized patient to some mannequins for procedures. <p><i>Example: expulsive delivery with an actress and a delivery simulator mannequin.</i></p>
Skills	<ul style="list-style-type: none"> Usually using mannequins with the purpose of training specific procedures and it is not necessary (but it is possible) to contextualizes a clinical case. <p><i>Example: intrabone puncture.</i></p>

of qualified teachers, and the finance must be mapped in advance to optimize the use of the simulation center.

This curriculum insertion process must be reviewed with all teachers involved in the pedagogic project in order to integrate simulation training sessions into the ordinary activities of the module or subject, assuring their pedagogic consistency. In this context, the first step must be to have a group of teachers who know and master the concept of simulation training and are motivated to implement it. In case the institution does not have this group in its staff, it must select teachers to receive specific training.

Faculty development can be promoted with activities that are formal, informal, individual or group. Faculty development begins with training to correctly use the mannequins and continues with support to prepare realistic scenarios. It is also important to support teachers in the acquisition of the necessary skills and competences to facilitate debriefing. Most faculty development strategies however are held as workshops or immersion courses, which often is outside the teachers' reality. In this sense, faculty development strategies for simulation training are more successful when directly aiming at teachers' reality; preferably approaching their problems directly, in a longitudinal way such as specific "*coaching*" for simulation. A new pedagogic modality must be repeated at least 20 times before becoming natural for a professor [17]. The best scenario occurs when it is possible to create a community of practice of teachers allowing the exchange of experiences, innovation, contextualization of simulation training and to the reality of the institution.

The second step is to plan the specific modules in which simulation training will be initially inserted. Teachers and students must be motivated to change and willing to accept simulation as a teaching methodology. No matter how we invest in scenarios fidelity, the agreement between students and teachers is always essential for the success of the simulation training.

Unfortunately, the structuring of a simulation center often directs the managers' attention to the acquisition of sophisticated simulators alone, resulting in the purchase of low- and high-fidelity mannequins, in the construction of simulation rooms and centers as initial phases. However, without a pedagogic culture change in the institution, many of those extremely expensive centers become sub-used. Several simulation centers in Brazil and abroad are sub-used due to lack of qualified professionals, lack of space in the curriculum and of interest by other professionals.

LOGISTICS

After identifying the target public, it is important to carry out a survey of logistic issues. An environment that will be used for residents' qualification or continued education can naturally require more rooms and specific or advanced simulators with audiovisual features than an undergraduate course in which demands for simulated rooms with various mannequins for technical skills training are imperative. For specific skills training it will also be essential to have wide rooms (which do not necessary have evaluation purposes) with structures to keep all materials, mannequins and simulators in an organized and simple way for daily routines. A support room with a significant quantity of equipment is valid; the mannequins and simulators require many materials for maintenance.

The simulation rooms for advanced clinical training should consider some specificities such as acoustic, audiovisual features, lavatories, sockets, control room, Wi-Fi, air conditioning (essential for simulators), and debriefing (discussion) room. Although there is not a predetermined size for the planning of a room, it should consider the scenarios that will be proposed to check the number of materials involved in simulated assistance (emergency vehicle, mechanic ventilator, serum support, rigid board, among others), according to the example in **Figure 1**.

The control room, represented by **Figure 2**, is the environment where the computers, resource for the simulated patients' voice, and exams insertion in real time are present together with the technicians, instructors or teachers, and in general it does not need to be very broad. The debriefing room should take into account comfortable desks which can preferably be placed "in circle" for the subsequent discussion, as well as recording and sound features which must be programmed carefully, as they usually cause the biggest technical difficulties of this type of environment.

As soon as the type of simulation and the specific demands are determined, the physical space should be planned. At this moment, it is important to consider lockers to keep personal belongings, restrooms, stockroom, a room for the actors and lecturing team or instructors, a coffee environment, and classrooms. In addition, physical space for a multi-professional team composed not only by the teachers but also by an architect, an engineer, an information technology professional – in case of advanced simulations – and a manager should be created. In **Figure 3** an example of floor plant can be viewed.



Figure 1. Example of a simulation outpatient center with three beds.
(Source: Simulated Hospital of Universidade Cidade de São Paulo)



Figure 2. Example of a command room for advanced simulation rooms.

(Source: College of Medical Sciences, State University of Campinas)

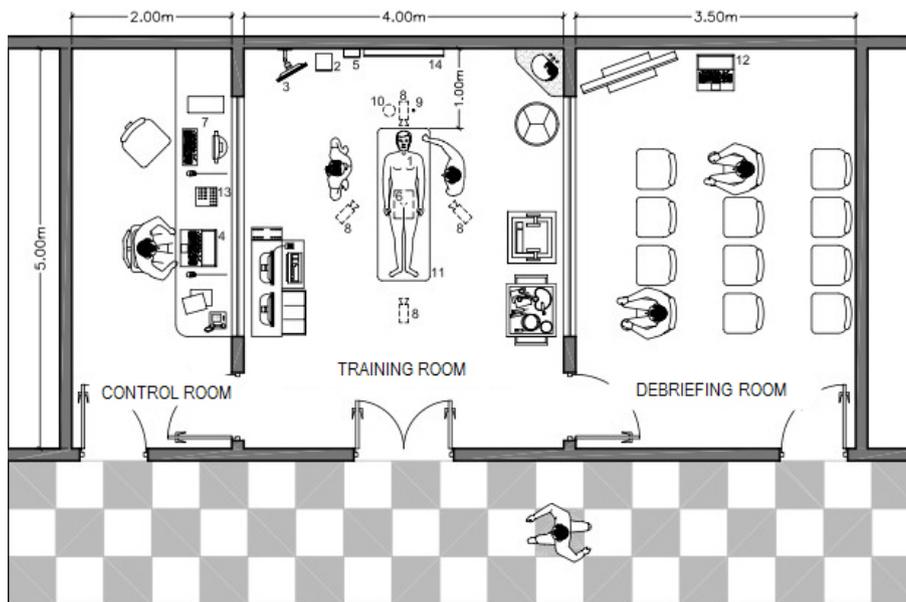


Figure 3. Example of construction of an advanced clinical simulation room.

(Source: Image kindly assigned by Laerdal Medical do Brasil)

Therefore, before structuring the simulation center physical floorplan it is important to understand and plan the activities that will be carried out in it, so that the dimensions are compatible with the future utilization of the space. This is important to assure that the center is not sub-used in the future, which might jeopardize the incorporation simulation training in the curriculum. At the same time, it is important to consider the international perspective of expanding and developing that area, especially for continued education.

USE OF THE SIMULATION CENTER

Evaluation

Simulated environments are also extensively used to evaluate students [18]. This educational strategy is used as an evaluation tool in institutional accreditation systems, hiring of professionals, and entree requirement for internship and health undergraduate programs, inasmuch as technical and behavioral skills are checked. Probably the best known among those forms of evaluation, but which can also be used for training,

are simulated practices referred to as “OSCE”, an abbreviation meaning *Objective Structured Clinical Examination* [19], and for technical examinations referred to as “OSATS”, an abbreviation meaning *Objective Structured Assessment of Technical Skill* [20]. In general, the used of simulated environments as means of evaluation has been supported by psychometric studies (for a review, please see Cook et al. [21]). Such studies demonstrate that evaluations by means of simulators are valid and reliable.

In more advanced simulations in which there is a team to be trained it is more difficult to measure the performance of each student or professional, requiring educational practice. Suitable instruments that may contemplate the entire cognitive and behavioral dimension involved in the process are scarce and rarely validated for use in different cultures and scenarios [22]. The development of suitable instruments is essential for a good evaluation, either formative or summative. In formative assessment, it is important that all evaluations be directed towards the educational aspect. Formative assessment should be as valid and reliable as summative assessment.

Research

The universe of educational research aimed at simulation training is quite vast. Firstly, researches focused on investigating whether simulated training could improve learning, as well as the validity of using simulators (for review, please see Cook et al. [23] and Cook et al., [21], respectively). Nowadays, researches are essentially directed towards improving training itself and transfer to patients’ care. However, there still are several research opportunities, for instance, comparative studies between simulation methods, associative, longitudinal and validation studies, which are options for research with simulated training as well.

Teaching-service integration

Simulation centers represent a unique opportunity to integrate clinical services to human resources formation centers in the healthcare field. Internationally, the main partnership happens between medicine and nursing courses and hospital services. Universities gain financing and interaction opportunities with the partnership, one of their purposes, and hospitals gain qualification and increase their patients’

safety. Moreover, with the significant number of medicine schools in Brazil, which may share the same geographical space, the idea of entering into agreements to create and maintain simulation centers may be quite cost-effective and serve as an alternative to make modern simulation centers feasible.

FINAL CONSIDERATIONS

The inclusion of simulation training into medical training and in other healthcare areas, with the accelerated evolution of technology and informatics, aims at constantly improving technical and non-technical skills, as well as the students’ clinical reasoning, replicating – safely and realistically – critical situations that may be faced by those professionals.

A simulation center planning is an arduous task requiring visits to already existing centers, budgetary studies, curriculum planning, faculty development, and multi-professional environment. Moreover, various factors should be considered for simulation centers optimal use. Integration among educational use (undergraduation, post-graduation, continued education) and research are of paramount importance for simulation use, as well as development of new training and knowledge.

Improving the existing simulation centers may create a culture in which the patients’ safety is the initial phase of any pedagogic planning in the formation of healthcare professionals. Obviously, the use of simulation training does not compete with or exclude practice in real life. The simulation training prepares students and qualifies physicians and other health professionals to improve their learning during practice in real life.

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Conflicts of interest disclosure

The authors declare no competing interests relevant to the content of this article.

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