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Best practices to impart clinical skills during preclinical years of medical curriculum

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Abstract:

Globally, health is regarded as a booming industry with greater stress being laid on high quality, accountability, and transparency. Traditional medical curricula rely primarily on clerkships during the clinical period of study to train clinical skills, while the preclinical period is mainly used to teach the basic sciences. In recent years, the early introduction of clinical skills training has received increased attention. This review aims to identify and summarize teaching approaches of clinical skills for medical students during preclinical years, namely, (1) framing objectives (2) learning activities, and (3) evaluation strategies. Although the clinical tutor's role is to ensure that students receive effective preclinical skills through different modes of learning (lectures, presentations, and problem-based learning), the role of advanced technologies, namely, simulation-based learning platforms and gamification are found to be very successful. To improve the communication skills, there is strong evidence in support of role plays, and similarly, for enhancing observation skills, an introduction of fine arts in clinical skills training was found to be very useful. Medical schools worldwide should give high priority to conduct faculty development programs on various aspects of training and teaching modalities, evaluation strategies, and improving the evaluation of various clinical skills. Students should be provided with sufficient learning opportunities including a well-equipped clinical skills laboratory and individual attention, and constructive feedback should be given to students for building their confidence level during their learning process.

Keywords:

Clinical skills, evaluation, fidelity, gamification, medical education, problem-based learning, role-plays, simulation

Introduction

In this globalized and technologically advanced world, health is regarded as a booming industry with greater emphasis being laid on high quality, accountability, and transparency. Over the last few decades, the competency-based approach has received attention from the medical educators believing that it has the potential to improve health professions education. Competency-based curriculum with well-stated learning objectives provides a blueprint for medical

institutions determining the modes of training and assessment for students to acquire competencies, including essential clinical skills.^[1] There is much documentary evidence which emphasizes on medical school graduates to acquire the essential knowledge, skills, and attitudes that are required for them.^[2,3] There is a great need for advanced technologies to bridge the gap between traditional "didactic" medical teaching (lectures, tutorials, laboratory work, and bedside consultations) and problem-based learning (PBL).

PBL is one of the effective approaches in medical education that help students

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developing various skills such as problem-solving, critical thinking, teamwork, and communication skills.^[4] Since its inception in McMaster University in 1969, PBL has become a popular learning approach among the medical institutions across the world, including the University of the West Indies.^[5,6] Simulation-based medical education (SBME) is another useful pedagogical approach that provides medical students with opportunities to practice their clinical, problem-solving, and decision-making skills to cope competently with real-life critical situations in a planned and prescribed manner without compromising ethical and legal rights of patients. In a meta-analysis, McGaghie *et al.* found SBME as superior to didactic medical teaching in practicing a wide range of clinical skills.^[7] Simulation technology has become widely popular worldwide to supplement skill training in medical education.^[1]

Traditional medical curricula rely primarily on clerkships during the clinical period of study to train clinical skills, while the preclinical period is mainly used to teach the basic sciences.^[3,8] Due to the limited clinical exposure during preclinical years, students experience difficulties in applying clinical skills when they get promoted to clinical rotations in Phase 2 Medicine.^[9] As a result, students can become quite stressful while transiting from preclinical to clinical training.^[10] In recent years, the early introduction of clinical skills training has received increased attention.^[11] The term “clinical skills” encompasses history taking, physical examination, using diagnostic reasoning, effective communication, and teamwork.^[2] Early introduction of these skills would facilitate the integration of clinical and basic science knowledge and in turn help students in the development of their clinical competence.^[12] The literature also supports that students feel more prepared when clinical skills are introduced early in their curriculum.^[10,13] It increases their confidence, improves performance, makes them “feel” like doctors, and also helps them to best prepare for their clerkship phase.^[14]

This review aims to identify and to summarize teaching approaches of clinical skills for Phase 1 medical students at preclinical years which also provide evidence for effective learning of these skills. This paper covers three broad components, which are essential in imparting skills effectively in the preclinical years, namely, (1) framing objectives (2) learning activities, and (3) evaluation strategies.

Framing Learning Objectives

Clear statements in educational settings about expected competencies are critical in medical education.^[15] There

is an extensive literature emphasizing the need for standardized curriculum components that enable students to learn, practice, and demonstrate their competence in basic clinical skills and knowledge.^[3] However, there is little formal guidance existing on the clinical skill competencies requirement.^[16] The fundamental purpose of clinical training at Phase 1 level is to initiate the clinical performance development and to prepare the students to participate confidently in their clerkship training. Clinical curriculum with proper learning outcomes, content, training, and assessment methods will give proper direction to the instructors, tutors, and students in the skill training exercise.

To develop the curriculum for skill training, a clinical training curriculum development committee should be established with all the stakeholders such as skills laboratory, clerkship and course/block coordinators, preclinical and clinical heads, senior lectures, and clinicians. While developing the clinical curriculum, the committee should make sure that the learning outcomes are optimally correlated and aligned with the fundamental clerkship goals.^[11] Example of learning outcomes for the preclinical skills are as follows: Students should be able to-

- Develop a patient-centered approach
- Obtain an appropriate history including family and socioeconomic backgrounds, lifestyle, and occupational health
- Understand the significance of pathophysiology in clinical presentations
- Perform mental and physical examinations
- Use effective and empathic verbal and nonverbal communication and documentation
- Peer communication and multidisciplinary approach
- Understand the significance of ethics in clinical care decisions.

Learning Activities

The learning activities include a range of issues, including the provision of skills laboratory, providing the students with dedicated tutors, and expanding training methods using hi-tech methods such as simulation and gamification.

Establishing a clinical skills laboratory

Establishing the clinical skill laboratory (CSL) for students in the early phase of their medical training has potential benefits for medical students.^[2,17] The CSL, commonly known as “skills lab,” is equipped with multiple facilities that provide clinical training facilities to conduct history taking, interview, physical examination, and diagnostic and therapeutic procedures which are essential for students before practicing on real patients.^[18,19]

Medical schools should utilize the CSL to support students in the acquisition of the clinical skills through hands-on training in a safe and zero-risk environment, according to the individual needs.^[19] While practicing in CSL using different models, mannequins, video clippings, and other equipment, students get the opportunity to learn from their mistakes and also it is not harmful to do error because they are not directly exposed to patients. Students acquire the necessary skills and are properly assessed before practicing on real patients.^[16] To provide proper skills training aligned with the set learning outcomes, medical schools should mandate the rotation of students in CSL during the preclinical years. Learning in CSL allows students to apply the theoretical knowledge obtained in the basic sciences taught in lectures.^[20] The coordinator of CSL should guide students about the use of equipment, dress code, safety issue, appropriate behavior, handwashing, and other necessary guidelines to practice in skill laboratory sessions.

Defining the role of clinical tutors and training

The teacher plays a significant role for the preclinical students, particularly in preparation for their clinical years, through his experience, action, attitude, and enthusiasm toward the subject matter. The primary responsibility of the clinical tutor is to ensure that students receive effective preclinical skills training through different modes of learning.^[21] Before giving clinical skills training, the tutor must be clear about the learning outcomes for each activity and learning opportunities. It is essential for the tutor to be mindful of what is being taught, the knowledge and skills that will be required of the teacher, as well as the knowledge of evaluating the performance of the students. Besides the mastery of clinical skills, the tutor must have the knowledge of medical sciences, general medicine, empathy, medical ethics, and respect for patients and above all, he should be able to provide a positive learning environment.^[22]

In addition, the tutor should establish rapport with the students and make them comfortable to participate actively in learning different clinical skills. Thus, it is essential for the tutor to understand students' prior knowledge, motivation level, and learning needs to make the teaching more effective. The tutor has to give due attention while students perform any skill and give them proper guidance and feedback when they are going in the wrong direction. It is critical that tutors who are assigned the task in the clinical skills training should have appropriate training in the methods to be adopted so that it helps students to achieve the learning outcomes.^[23] According to Shields *et al.*, the leadership role of a tutor in the discussions is very significant where he/she asks the questions, summarizes, and uses schematics to illustrate concepts to the students. Apart

from that, the tutor also has a significant and positive impact on learning in tutorials, meeting the course objectives, improving overall course satisfaction, and standardized national examination's mean score.^[24]

Expanding modes of training

Medical schools should use various teaching methods that enable students to acquire the preclinical skills. Some of the essential methods that influence students learning of basic practical skills include simulated learning, multimedia instruction, PBL, seminar, and dialectic learning such as lectures and laboratories.

Simulation

The traditional medical education and training have always emphasized student interaction with real patients in clinical settings. Whereas a simulation environment allows the medical students and practicing clinicians to learn, practice, and repeat procedures as often as necessary to correct mistakes, overcome the incompetencies, fine-tune skills, and optimize clinical outcomes.^[25] Simulation refers to the artificial representation of a complex real-world process with sufficient fidelity to achieve a particular goal such as in training or performance testing [Figure 1].

The ultimate aim of simulation is to facilitate the learning process through immersion in the clinical scenario, reflection, feedback, and practice minus the risks inherent in a similar real-life experience.^[26] Fidelity is the standard industry term commonly used in simulation world to describe the degree of realism and technical complexity of models which is dictated by the needs of the application (more complexity of the task and more is the fidelity of the model) as shown in Figure 2.

The notion behind this idea concerning the fidelity of simulation is based on the assumption that more the learning context resembles the context of practice, the better the learning.^[27] Therefore, by employing the techniques of simulation in medicine, we can transform medicine from the old method of "See One, Do One, Teach One" to a "See One, Practice Many, Do One" model for greater success.^[28] Globally, simulation is a powerful learning tool in contemporary medical education systems to benefit modern health-care professionals to achieve higher levels of competence and to deliver quality

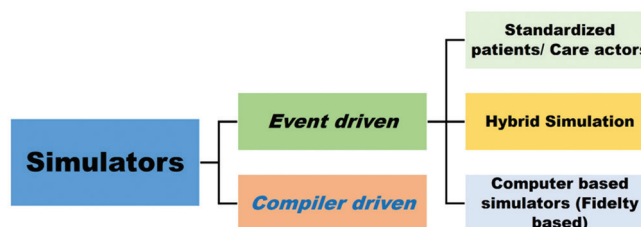


Figure 1: Classification of simulators

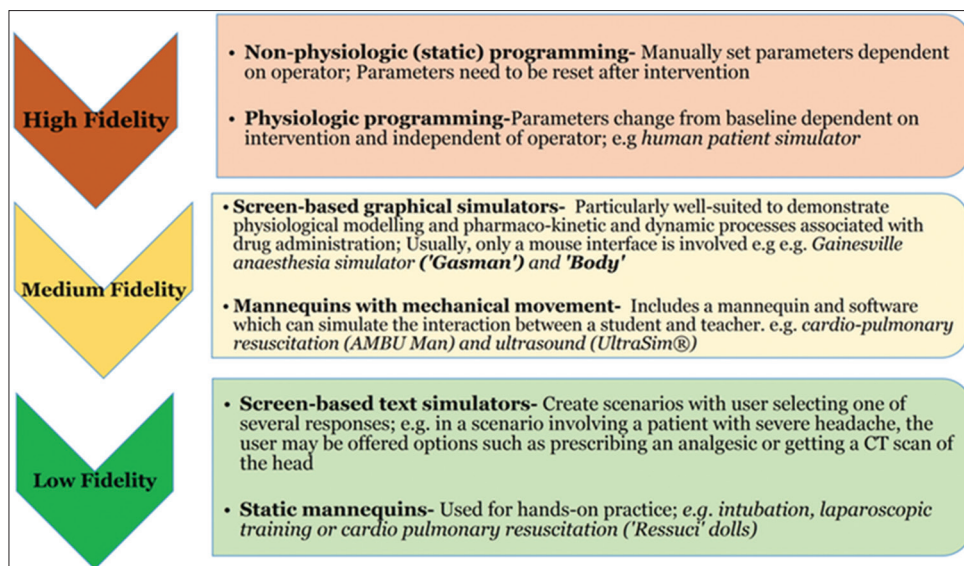


Figure 2: Classification of simulators as per fidelity

care.^[29] Therefore, to improve the hands-on experience by enhancing the performance of medical professionals, the application of simulation in the undergraduate medical curriculum is well promoted and accepted by health-care educators worldwide.^[14,30] The Harvard Medical School's study to assess the utility and value of practicing communication skills with real patient volunteers and physician coteachers by medical students concluded that medical students highly rated practicing communication skills with real patient volunteers during their preclinical years.^[31]

There are mainly five types of physical simulation settings, namely, (1) off-site simulation in the simulation center, (2) off-site simulation in-house in the department, (3) *in situ* simulation, (4) *in situ* simulation announced, and (5) *in situ* simulation unannounced. The study by Sørensen *et al.* concluded that despite having different simulations, the choice of physical setting for simulations does not influence the learning for individuals or teams.^[32]

To be an effective education tool, simulation integration can be achieved through an interdisciplinary approach. To provide the best quality of education and imparting clinical skills to the undergraduate medical students in preclinical years, the simulation learning platforms have to be given a high priority by appointing a dedicated program director, allocating capital equipment, a dedicated budget, and office space for optimum performance.^[33]

Gamified training platforms

Since medical education is rapidly evolving with technological advances, many medical schools are adopting and encouraging technology-enhanced active learning and multimedia education applications.

Gamified training platforms include education games, mobile medical applications, and virtual patient simulations.^[34]

- i. Electronic games are “instructional methods” requiring the learner to participate in a competitive activity with preset rules
- ii. Medical mobile applications are medical software applications used on handheld devices such as personal digital assistants, cell phones, or tablet devices
- iii. Virtual patient simulations are interactive computer simulations of real-life clinical scenarios for medical training, education, or assessment.^[35] These learning exercises provide “situated learning,”^[36] a process whereby trainees gain orientation to a professional culture by participating in activities of the practice through a limited, mentored apprenticeship, gradually assuming responsibility over time.

A recent study found that games have the potential to promote learning, increase engagement, allow for real-world application, and enhance collaboration. They can also provide opportunities for risk-free clinical decision-making, distance training, learning analytics, and swift feedback.^[34] “Gamification” involves the application of game design elements to traditionally nongame contexts and is one of the strategies in the simulation. Gamification is “the process of game thinking and game mechanics to engage users and solve problems.”^[37] Game-based learning (GBL) in medical education is emerging as a valid alternative to traditional teaching methods. Well-designed GBL sessions use nonthreatening competition to capitalize on heightened learner arousal, allowing for high-level engagement and dynamic group discussion.^[38] Selective,

purposeful gamification that aligns with learning goals has the potential to increase learner motivation and engagement and ultimately, learning. In line with self-determination theory, game design elements can be used to enhance learners' feelings of relatedness, autonomy, and competence to foster learners' intrinsic motivation.^[39]

Role-play

Role-play is defined as one particular type of simulation that focuses attention on the interaction of people with one another. It emphasizes the functions performed by different people under various circumstances. In the context of role plays in medical education, many studies have been published dealing with the effectiveness of role-plays in the field of communication and behavioral skills of medical students with the patients. Role-play is widely used as an educational method for learning about communication in medical education.^[40,41] It is used as a training method to acquire knowledge, attitudes, and skills in a range of disciplines and with learners of different ages (e.g., acquisition of language skills,^[42] cross-cultural training,^[43] medical science, business, and human resources).^[44] Although its use is widespread and educational theory provides a sound rationale for using this form of simulation, there is little published evidence for its effectiveness.

Role-play activities can be performed in different ways. For the acquisition of patient-centered interviewing skills, we tend to use the approach in which students play their role as a medical student; hence, they are expected to perform as they would in real clinical encounters. Role-play can be thoroughly scripted (all players act from verbatim scripts) or partially scripted (players have certain prompts – often an opening line). Alternatively, one player (e.g., patient) has been described their role while the other (e.g. student) has been provided with their task. Players can rotate through roles within a single role-play (switching) with the intention of gaining insight into other roles, or perspectives or players can be substituted at various points in the role-play by observers. Some role-play activities use role cards as a way of inserting new information into a role-play. A recent study conducted by Acharya *et al.*, in 2014, reported that role-play was reported to be an effective means of learning communication skills as almost all students reported role-play as an extremely valuable tool for learning clinical medicine. This study has provided a practical foundation for the use of role-playing as an educational method in the broader context of simulations in clinical medicine.^[45]

Introduction of fine arts in clinical skills training

There is evidence existing that introduction of fine arts in clinical skills training can improve students' inspection

abilities. Observational skills have always been the physician's most important weapon in the diagnosis, care, and treatment of the patient.^[46]

Clinical educators use medical humanities as a means to improve patient care by training more self-aware, thoughtful, and collaborative physicians. Visual thinking strategies (VTS), which is an evidence-based, widely used method of museum art education that lends itself well to cross-disciplinary, immersive, and sustained learning. According to Katz J, fine arts training is being used to address a variety of vexing deficiencies in medical education at Harvard Medical School and other institutions.^[47] Engaging medical trainees and professionals with works of art have the potential to solve some of the most vexing professional development challenges. "It is precise because art is so richly complex that our possibilities for learning from it are endless," according to Berg.^[48]

Dolev *et al.*, at Yale University, highlight the fact that the formal teaching of observational skills is rarely included in the medical curriculum through the visual details is a critical aspect of visual diagnosis or "seeing." The Yale study examined if the experiential process of seeing such visual details can be enhanced in medical students through systematic training using representational paintings. The study found that the intervention group had a significantly higher mean of posttest improvement scores than both the control groups.^[49] Another Harvard study based on VTS in the museum galleries and observation at the bedside as an elective course on "Training the Eye: Improving the Art of Physical Diagnosis," reported that strategic interactions with the visual arts could improve skills, and it is essential for students to apply them in a clinical context with faculty support.^[50]

The inspection skills can be enhanced by teaching visual literacy through structured observation of artworks, understanding of fine arts concepts, and applying these skills to patient care. A prospective, randomized pre- versus post-course evaluation study conducted by Naghshineh *et al.*, found that a "dose-response" was found for those who attended the sessions and had increased sophistication in their descriptions of artistic and clinical imagery.^[51] Another qualitative study to understand the similarities and differences between arts-based and clinical teaching approaches to convey observation and pattern recognition skills found that in arts-based conditions, students also developed skills in emotional recognition, cultivation of empathy, identification of story and narrative, and awareness of multiple perspectives.^[52]

Problem-based learning

In PBL, a small group of students presents a scenario where they require to understand scientific or health

system information; apply theoretical knowledge to set learning issues, hypotheses, and objectives; collect necessary information; revise their hypotheses; and finally reach a conclusion.^[4,53] The essential characteristics of PBL include the use of clinical problems rather than discipline-based learning, the integration of basic and clinical sciences throughout the course, and the development of higher-order cognitive skills as well as knowledge.^[54]

PBL as a learning method has been implemented in a significant part of medical education for half a century to improve the application of knowledge by students to diagnose and manage clinical problems.^[5] PBL is a very effective learning method in that it is a vehicle for stimulating academic study that enables the natural acquisition of clinical skills required for health professionals. The benefits of PBL include not only its promotion of efficient knowledge acquisition, self-directed learning, participation, critical thinking, self-reflection, collaborative learning, and communication skills but also many other skills and competencies that are necessary for success in the health professions.^[4,55]

Evaluation Strategies

The purpose of the evaluation is mainly to address the following five key areas:

- i. To communicate educational goals
- ii. To identify areas of learner deficiency
- iii. Determine the effectiveness of the course
- iv. Determine readiness to practice
- v. Increase learner self-reflection.

Miller's pyramid^[56] is a way of ranking clinical competence in educational settings, and as a framework, it distinguishes between knowledge at the lower levels and activity in the higher levels. It argues that to truly know whether our learners are achieving what we want them to achieve we should assess them in the setting that we expect them to be delivered. Miller's ideas strive to define education by its outputs and not by its inputs. At the end of any teaching intervention, we are interested in what learners can do, which is not the same as what we have taught them. Miller's pyramid is usually described

as having four levels; knows, knows how, shows how, and does. The higher levels have greater professional authenticity [Figure 3].

Formulating effective assessment methods and feedback

Effective learning requires effective means of assessment and feedback.^[57] These are the important methods that exhibit how far students have succeeded in achieving the learning outcomes and where they need further improvement in learning. Assessment plays a significant role in determining students' clinical skill learning.^[58] Formative assessment should be an integral part of the curriculum to assess the performance of students' learning behavior. Regular formative assessment helps students to prepare for the late summative objective structured clinical examination.^[58] Direct observation is an effective method to assess students' performance in demonstrating various clinical skills, including clinical reasoning, history taking, and physical examination.^[57,59] Even in PBL, tutor evaluates students' active participation, effective communication, and teamwork through the structured observation.^[4] Unfortunately, there is evidence that medical educators have significant deficiencies in direct observation evaluation skills.^[60] Medical schools worldwide should give high priority to conduct faculty development program to bring improvement in evaluating various clinical skills through the observation.

Whatever means of formative assessment mode are used by the clinical teacher, it should be followed by feedback to help students in the acquisition of clinical skills. Feedback given by tutors helps students to identify their weakness and also give them proper direction for further learning. Literature suggests that the provision of formative feedback has the potential to direct student learning by reinforcing desirable learning behaviors.^[57] Feedback is most effective when it is a bilateral process with participation by both the giver and receiver.^[61] Despite the apparent role of feedback in effective teaching and learning, students often complain that they do not receive adequate feedback. Thus, faculty training is required for the use of an effective methodical approach to provide constructive feedback to the students in the clinical setting.^[62]

Conclusions

The medical education should implement a multipronged approach by including a variety of modes of delivery to impart the essential clinical skills right at the start of their preclinical years. In addition to PBL, role-plays and introduction of fine arts in clinical skills training, the other platforms such as simulators, mobile applications,

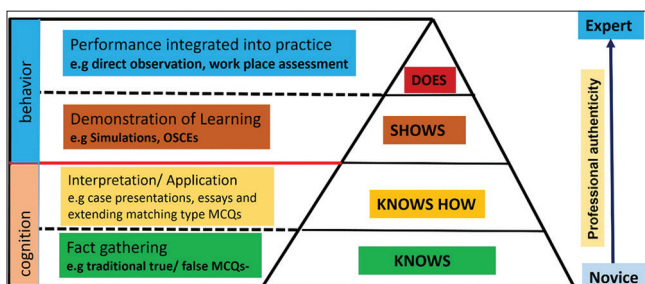


Figure 3: Miller's pyramid

and gamification also play a significant role in the development of essential clinical skills. Cultivation of skill acquisition in the foundation years of medical education depends on the revision of curriculum using appropriate learning goals and outcomes. Based on the authors' experience and the feedback from the students, a separate preclerkship clinical skill training orientation course for the students should be conducted with clear learning outcomes aligned with the overall outcomes of the medical program. Individual attention and constructive feedback should be given to the students for building their confidence level while learning various skills. Further, the faculty development program is recommended to assist tutors for effective teaching, facilitating, and self-directed learning. Tutors should design and implement strategies for evaluating the performance of students in achieving the expected learning outcomes.

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Conflicts of interest

There are no conflicts of interest.

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