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Virtual School - Tehran University of Medical Sciences

دانشکده مجازی

قطب علمی یادگیری الکترونیکی در علوم پزشکی

Introduction to
Simulation based Medical Education

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Definition

"The technique of imitating the behavior of some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training."

Oxford English Dictionary

Definition

Simulation based **medical education** (SBME)

 is **defined** as any **educational** activity that

 utilizes **simulation** aides to replicate clinical scenarios.

Abdulmohsen H. Al-Elq, 2010

Overview

❖ Becoming **more and more popular**.

❖ Becoming equal to **effective learning** and **safer care for patients.**

❖ Becoming a solution for all the perceived ills of teaching and training.

Overview

❖ **Is not a substitute with and from real patients in real clinical contexts.**

❖ **Must not become an end in itself, disconnected from professional practice.**

❖ **Simulation is a technique, not a technology!**

Gaba D. M. (2004). The future vision of simulation in health care. *Quality & safety in health care*, *13 Suppl 1*(Suppl 1), i2–i10. doi:10.1136/qhc.13.suppl_1.i2

Overview

☐ **Simulation is a complimentary teaching method in the medical profession:**

"any educational activity that uses simulative aids to enhance medical educational message"

"not to replace traditional methods, but to add to"

Widespread

❖ **The use of simulation-based training:**

➢ **Undergraduate and postgraduate contexts,**

➢ **General and specialty curricula,**

➢ **Clinical and non-clinical settings**
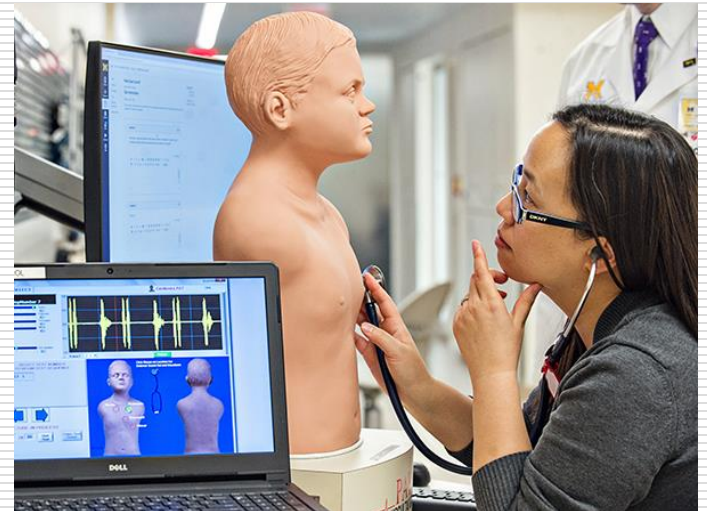
Effects

❖ **Simulation supports:**

➢ **1- The acquisition of procedural, technical skills through repetitive, deliberate practice with feedback.**

➢ **2- The acquisition of non-technical skills, such as communication, leadership and team working.**

➢ **3- Workplace-based simulation for established multi-professional teams**

Skills in Simulation based MD

Technical (procedural) skills

Non-technical skills

Workplace-based simulation

Technical Skills

Technical skills: SPs

❖ **Simulated patient** is an actor who is trained to represent a patient during a clinical encounter with a health care provider.

❖ If Simulated patient act similarly in all situations is named **standardized patient.**

Technical skills: SPs

❖ **The role of SPs in providing timely and accurate feedback from the 'patient's perspective' is one of the key advantages of involving SPs.**

❖ **Many SPs are also trained as educators who can work unsupervised in both teaching and assessment situations.**

Technical skills: SPs

❖ **It is important that SPs are selected, trained and supported in their role, particularly when they are involved in high-stakes assessments.**

❖ **SPs have also been used as covert patients to evaluate health services and the practice of individual doctors.**

Technical skills: SPs

❖ **Although planning and managing an SP service is time-consuming and can be costly in the initial stages, experienced SPs can replace clinicians in both teaching and assessments.**

❖ **Recent developments: accreditation, standards and certification of SPs.**

Technical skills: VR

❖ **The computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment,**

Virtual Reality

https://www.oculus.com

Augmented Reality

Microsoft Hololens

Technical skills: VR

- ❖ **Virtual reality simulators facilitate and measure tactile feedback in real time.**

- ❖ **Enable doctors to improve operating techniques.**

- ❖ **virtual reality has its own challenges and opportunities.**

Technical skills: VR

❖ **If the use of simulation training and assessment expands, then new simulation centres may need to be established that can efficiently utilize resources, equipment and expertise to train and assess large numbers of doctors and other health professionals.**

❖ **This would require a 'whole-system' approach to simulation.**

Non-technical Skills

Non-technical skills

❖ **Training and development of non-technical (social and cognitive) skills and the way in which human factors impact on patient safety.**

Non-technical skills

❖ **Human factors have been shown to cause the majority of errors and often these are not due to lack of knowledge or inability to perform a technical skill, but due to lack of so-called 'softer' skills like team working, communication, leadership and decision-making.**

Healthcare team

❖ **Teamwork failures: a major cause of errors.**

❖ **Simulation-based team training can help address some of the common issues concerning poor or ineffective communication and differing perceptions about the goals of healthcare, team roles and leadership.**

Other types

❖ **Social media**

❖ **Use of smart phones**

❖ **Blogs**

❖ **Podcasts**

❖ **Interactive questions before and after training is increasing.**

Place of SBT

❖ **A dedicated simulation centre is seen as an efficient and effective way of centralizing resources and expertise, particularly those around high-fidelity simulators or when large numbers of people are to be trained.**

❖ **Factors that need attention:**

- **Securing initial and ongoing funding;**
- **Determining training needs and the numbers of users;**
- **Recruiting, training and retaining faculty;**
- **Identifying the right equipment;**
- **Providing high-quality training;**
- **Quality assuring all activities.**

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Place of SBT

❖ **Many groups are starting to explore more cost-effective solutions to delivering high-quality simulations away from dedicated simulation centres. Distributed simulation (DS) is one solution to these problems.**

Place of SBT

❖ **DS is useful when resources are limited as only the most important features are used which help to generate a realistic scenario in any given context.**

❖ **Portability is achieved through the use of simple, user-friendly equipment for observing, recording, playback and debriefing.**

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A simple Classification of simulators

	Appearance	Interaction with the learner	Educational context
Part task trainer	Realistic, but of a single body part	Feels realistic but limited or no response	Repetitive practice of isolated skill
Full body simulator	Realistic body, often with associated physiological modelling	Allows examination (for example, pulses) and realistic interactions	Realistic practice of whole scenarios
Screen simulator	2D image of patient, equipment or staff	Realistic response to input via keyboard or mouse	Cognitive exploration of a variety of situations
Virtual reality	3D image of patient, equipment or staff	Realistic response to input via a variety of methods	Realistic practice, often of a defined task
Real people as simulators	Real people	Verbal and non-verbal communication	Practice of a variety of clinical skills
Hybrid simulation	Any combination of the above	Verbal and non-verbal communication and interaction	Realistic practice
Simulated environments	An entire clinical environment	Full interaction with patient and team	Realistic practice and team training

Instructional consideration

❖ **There is no difference between simulation and many other forms of education and training.**

❖ **Requires skillful and knowledgeable Instructors or facilitators**

❖ **Requires the skill of "providing feedback" (in the moment and structured debriefings)**

Instructional consideration

❖ **Assessment** drives learning

❖ Attributes of assessment should be considered:

   reliability, validity, feasibility, cost-effectiveness, acceptability and educational impact.

Instructional consideration

❖ **Assessments need to be integrated within the curriculum.**

❖ **Both formative and summative assessments should be considered.**

❖ **Appropriate levels of fidelity and realism should be selected.**

Instructional consideration

Critical behaviors that should be demonstrated

Patient examination	Met	Not Met	Comments
Vital signs: current vs. past 24 hours			
Symptoms: monitored & aware of changes			
Ventilation: RR, % saturation & breath sounds			
Cardiovascular: BP, HR, circulation & heart tones			
Integument: integrity, irregularities			
Level of consciousness: impact on intervention plan			
Communication: calm, clear directions & explanations			
Patient mobility: ROM, strength & bed mobility			
Body mechanics: correctly used by PT and patient			
Lines & tubes: identified potential problems/limitations			
Pt modesty maintained: Pt appropriately covered			

(Partial text visible at top of the form: "...to the ICU 48 hours ago with severe chest ... runs of ventricular tachycardia initially, but no arrhythmias ... of an acute myocardial infarction. Mr. Jones had ... a, arterial line, pulmonary artery catheter, ECG, urinary catheter ... current patient status and if he is ready to begin cardiac rehabilitation yesterday. You are to ... During simulation the participant should demonstrate their ability to ... by another physical therapist for initial evaluation ... Student Role: You are assuming Physical Therapy care for ... current patient status and assess the capacity of the patient to begin cardiac ...")

- ❖ **Providing opportunities for learners to receive timely and specific feedback.**

- ❖ **Developing clinical and communication skills.**

- ❖ **A large number of checklists and global rating scales have been developed, tested and validated in various settings.**

Instructional consideration

❖ **SBME enables educators to measure performance more consistent and reliable.**

❖ **Provides assurances for patients and the public that healthcare professionals are safe to practice.**

Instructional consideration

❖ **Without the continued involvement of trained, enthusiastic and skilled people, simulation education will not flourish and grow.**
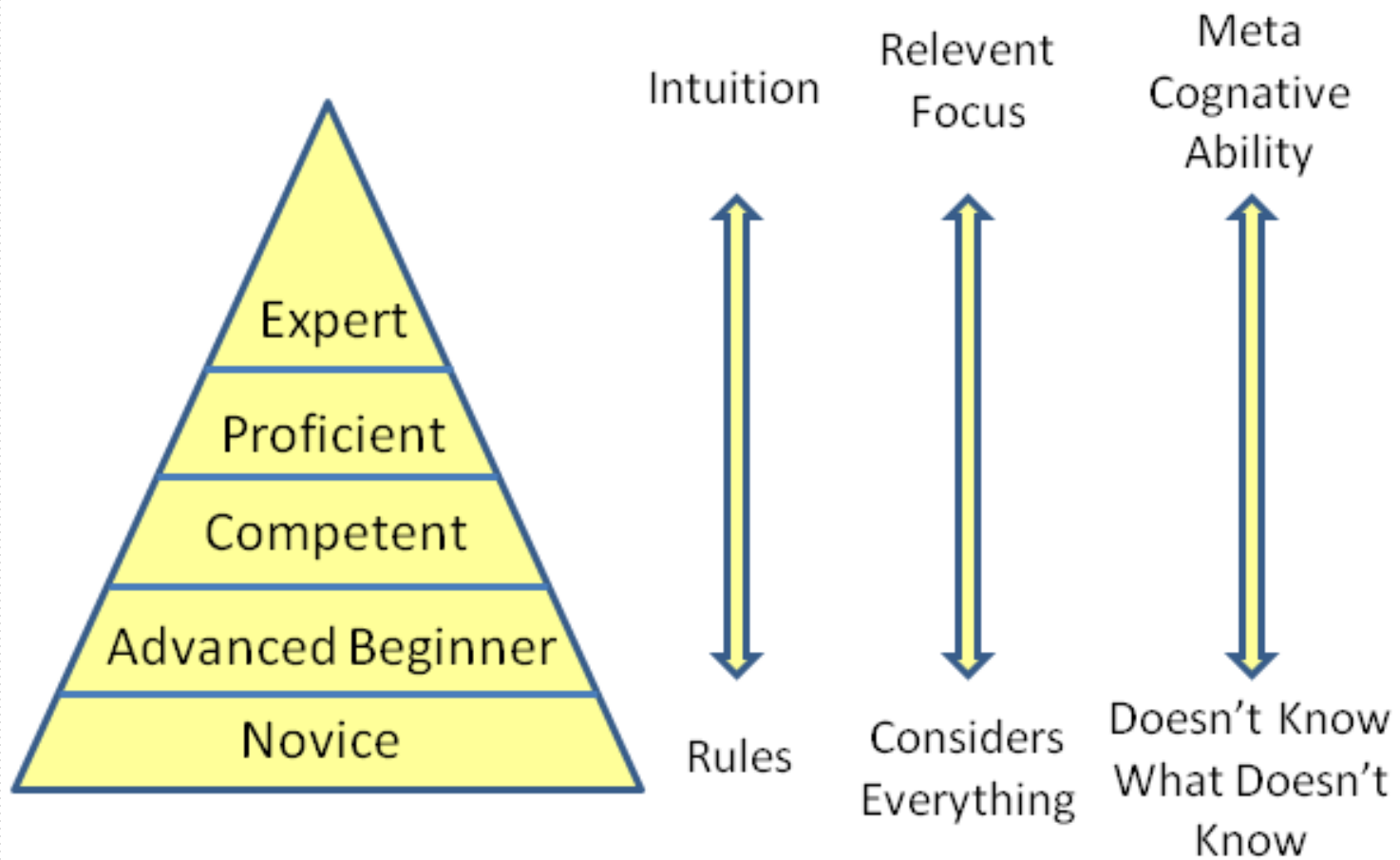
Dreyfus Model Of Skill Acquisition

Expert
1. Transcends reliance on rules, guidelines, and maxims
2. Intuitive grasp of situations based on deep understanding
3. Has a vision of what is possible
4. Uses an analytical approach in new situations

Proficent
1. Holistic view of situation
2. Prioritizes importance of aspects
3. Perceives deviations from the normal pattern
4. Employs maxims for guidance, with meanings that adapt to the situation at hand

Competent
1. Coping with crowdedness (multiple activities, accumulation of information)
2. Some perception of actions in relation to goals
3. Deliberate planning
4. Formulates routines

Advanced Beginner
1. Limited situational perception
2. All aspects of work treated separately with equal importance

Novice
1. Rigid adherence to taught rules or plans
2. No exercise of discretionary judgment

Simulation report card for patient safety.

COMPETENCY	DESCRIPTION
Medical Expert	Strong evidence base for the use of simulation to teach procedural skill, and emerging evidence that this protects patients from risk. Opportunities to routinely teach healthcare practitioners by simulation remain rare in many settings.
Communicator	Strong evidence of the use of simulation to teach and assess communication skills. While OSCEs are often used to assess communication skills, simulation is still underused to teach communication skills, with the exception of some medical schools.
Collaborator	Strong evidence base for the use of simulation to teach team working skills. Team working scenarios are expensive and time consuming to run, so are seldom used in practice.
Scholar	Simulation may be used to promote reflective practice, and encourage learning by observing and reflection. The evidence base for its use remains poor.
Professional	Simulation is increasingly seen as a means to assess professionalism. As simulation is grounded in scenarios, which are observed and discussed, rather than didactic classroom lessons, it provides a rich opportunity for teaching professionalism that is currently being missed.
Manager	Simulation has potential to be used to teach management and leadership skills which are important for patient safety, but the evidence base is weak.
Health Advocate	Simulation has potential to be used to train patient safety advocates, but its use in this area has not been developed.

Simulation has no use in this role

Simulation has potential to be used in this area, but is either underused or its evidence base remains weak

Simulation is shown to work in this area, although evidence for its use in patient safety may still be under researched

Rajesh Aggarwal et al. Qual Saf Health Care 2010;19:i34-i43

BMJ Quality & Safety

اخلاق
در آموزش پزشکی مبتنی بر شبیه سازی

دکتر آیین محمدی

اخلاق در شبیه‌سازی

☐ **استفاده از بهترین استانداردهای برای مراقبت و آموزش**

Best standards of care and training

☐ **مدیریت خطاهای پزشکی و امنیت بیماران**

Error management and patient safety

☐ **اختیار داشتن بیماران** (Patient autonomy)

☐ **قضاوت اجتماعی و تخصیص منابع** (Social justice – resource allocation)

اخلاق در شبیه‌سازی

"patients are to be protected whenever possible and they are not commodities to be used as conveniences of training."

Ziv A, 2003

۱. استفاده از بهترین استانداردهای برای مراقبت و آموزش

✓ **بهترین استاندارد برای مراقبت از بیمار:**

❑ هیچ آسیبی نباید به بیمار برسد:
❖ استفاده از بیمار به عنوان ابزار یادگیری تنها در زمانی قابل قبول است که خطرات احتمالی به حداقل کاهش پیدا کرده باشد.

❑ شبیه سازی باعث می شود که تنها دانشجویانی که توانمندی لازم را کسب کرده‌اند اولین مواجهه به بیمار واقعی را داشته باشند.

۱. استفاده از بهترین استانداردهای برای مراقبت و آموزش

✓ **بهترین استاندارد برای آموزش:**

☐ مسوولیت مدرسان برای فراهم کردن بهترین یادگیری

✓ **بهترین استاندارد برای ارزشیابی:**

☐ ارزشیابی های سنتی بر حیطه شناختی متمرکزند
☐ به کمک شبیه سازی می‌توان نگرش و مهارت را نیز ارزشیابی کرد.

۲. مدیریت خطاهای پزشکی و امنیت بیماران

☐ حتی با نظارت مستقیم هم ایجاد بعضی از صدمات غیر قابل اجتناب است.

☐ در محیط بالینی حقیقی خطاها باید به طور اساسی متوقف شوند.

☐ در شبیه سازی می توان اجازه داد تا خطاهای احتمالی رخ دهد.

☐ خطاها در هر سطحی از آموزش پزشکی می‌تواند رخ دهد:

❖ عمومی، تحصیلات تکمیلی یا آموزش مداوم

۳. اختیار داشتن بیماران

☐ بیماران حق دارند که مراقبت از خود را هدایت کنند

□ اصول کلی قضاوت جامعه:

❖ خطرات احتمالی نوآوری در پزشکی، تحقیقات و آموزش باید به طور مساوی بین شهروندان تقسیم شود.

□ بیشتر مراکز دانشگاهی در شهرها قراردارند و مراقبت‌های مناسبی به افراد فقیر ارائه نمی‌دهند.

□ شبیه سازی میتواند این عدم تناسب را بهبود ببخشد.

What is fidelity?

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What is fidelity?

"is the extent to which the appearance and behavior of the simulation match the appearance and behavior of the simulated system"

Maran NJ

Low fidelity vs high fidelity simulation

➢ In training, low-fidelity simulations **leave out some or many elements of the real-life** experience so that the user can grasp the smaller concepts leading up to the whole of what they are learning.

➢ High-fidelity simulations **mimic real life as closely as possible**, and are frequently used as a substitute for hands-on training that would be too risky and cost too much to execute.

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A. Ziv's definition of High Fidelity

1. Screen based simulator

   ☐ **May or may not interact**

2. Procedural simulators (task trainers)

   ☐ **Static models with tactile cues**

3. Realistic Patient Simulators

4. Virtual reality

   ☐ **Evolving technology**

   ☐ **Combine virtual world with simulation +/- standardized patients to form micro-systems**

A. Ziv's definition of Low Fidelity

1. Simple 3-D models
2. Animal models
3. Human cadavers
   - ☐ **Realistic but lack physiologic response**
4. Basic Plastic Manikin
   - ☐ **Simple skills trainers**
   - ☐ **Physical exam teachers**
   - ☐ **Clinical skills teachers**
5. Simulated or standardized patients
   - ☐ **Best for clinical skills teaching**

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□ **آیا آموزش‌های (Low Fidelity) موثرند؟**

"Learning transfer is the application of skills and knowledge learned in one context to another context."

Hamstra SJ. 2006

آیا آموزش‌های (Low Fidelity) موثرند؟

آیا آموزش‌های (Low Fidelity) موثرند؟

In medical training for doctors and nurses:

❖ The preference is on shorter, low-fidelity simulations that help them to master individual tasks.

❖ The main disadvantage of using high-fidelity simulations in the medical field is that they place more mental strain on the user and allow for fewer mistakes.

□ **آیا آموزش‌های (Low Fidelity) موثرند؟**

□ 40 final year medical students
  ■ Assigned to low-fidelity, high-fidelity, didactic group

□ Trained to remove stone from mid-ureter

□ Performance measured on expert rating scale and time to completion

No difference between low and high fidelity

Hamstra SJ. 2006

۷ مرحله برای آموزش مهارت‌های تکنیکال و پروسیجرال:

- ☐ ۱- ابتدا طراحی کوریکولوم آموزشی

- ☐ ۲- سپس آموزش دانش شناختی مورد نیاز برای انجام مهارت به دانشجویان

- ☐ ۳- نمایش تکنیک به همراه توضیحات به دانشجویان

- ☐ ۴- انجام مهارت توسط دانشجویان تحت نظارت کامل

- ☐ ۵- تکرار و تکرار

- ☐ ۶- ترغیب دانشجو به ارزیابی خود (Reflection)

مشکلات آموزش پزشکی مبتنی بر شبیه سازی:

- ۱- مقاومت فرهنگ آموزش پزشکی در مقابل تغییر

- ۲- نیاز به مدل مناسب برای یکی کردن اهداف آموزشی با اهداف دانشجویان

- ۳- نیاز به تربیت مدرسان و استادان

- ۴- برگزاری آزمونهای کمی با روایی قابل قبول

- ۵- طراحی مدل مالی قابل قبول برای مرکز آموزشی

- ۶- اثبات کاهش هزینهها برای مراقبتهای سلامتی همزمان با کاهش خطاهای

پزشکی

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References

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ESSENTIALS

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