White Paper

> *The remarkable feature of the evidence is that the biggest effects on student learning occur when […] students become their own teachers*
>
> John Hattie, 2009

Peer-to-Peer Simulation in Healthcare

A Brief Introduction to the Concept, Pedagogy and Research

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PEER TO PEER

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Contents

Background

An Institute of Medicine report from 2018 estimated that in the USA alone, more than 400 000 persons die per year from preventable mistakes or harm during surgery or in the care of healthcare personnel [1]. These numbers are likely to be the same, relatively speaking, in most high-income countries, and most likely more devastating in low -and medium income countries.

A landmark study published in the Lancet in 2018 [2], established that the leading cause of death and illness globally is no longer access to healthcare, but rather the quality of care provided.

Both the above studies mention education in general, and simulation specifically, as ways to improve both the education and the quality of care delivered by healthcare personnel.

About Simulation

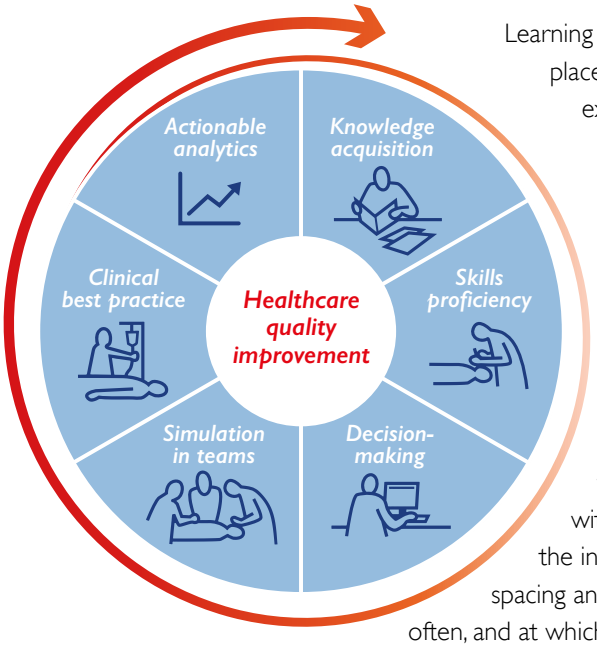
Modern day simulation can be traced back to the early 1960's, when Bjørn Lind and Peter Safar creatively sought out and worked with the Norwegian toy manufacturer Aasmund Laerdal to develop a realistic, full-size manikin for mouth-to-mouth breathing and cardiopulmonary resuscitation. The goal was to allow lay providers and healthcare personnel to practice these effective, lifesaving skills to mastery level without having real-life patients available.

Since then, the simulators have developed considerably. With the help of technology available at any given time, the pursuit of improved relevance and realism has brought forward highly advanced patient simulators very close to what we would consider human-like robots.

The Circle of Learning and Maintenance of Competence

The Circle of Learning defines six segments or steps to reach the desired competence. Each step focuses on the learner as the directly active agent The teacher is seen primarily as a facilitator. The steps can be seen as a description of a process, and also as singular learning approaches to meet specific learning objectives.

The Circle of Learning

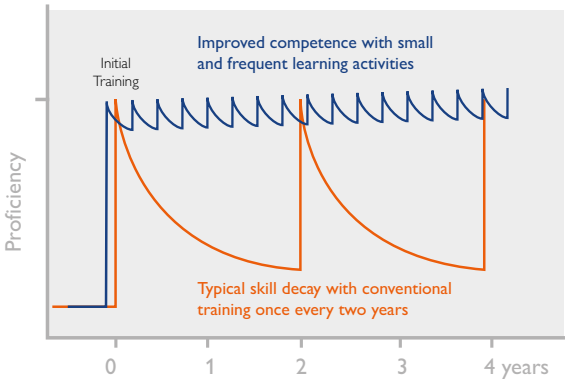


Learning something for the first time normally takes place without the help and comfort of relevant experience and contextual knowledge. True competence is the effect of the combination of suitable learning and deliberate practice. The Circle of Learning describes a process to acquire and improve desired competence and how it needs to transfer to clinical best practice. It also describes approaches to achieve educational efficiency by devising a natural progression from individual, cognitive learning; through skills training; towards team-based learning models, and alignment with clinical best practices. Key considerations for the initial acquisition of competence are quantity, spacing and advancing. In other words: How much, how often, and at which level. From the perspective of improving the quality of care given, The Circle of Learning suggests applying metrics which lends themselves to measurement. Both by creating a baseline for the learning, and by ensuring the effectiveness of the educational interventions.

Acquired competence and skills will decay over time if not maintained [3]. This may rapidly become a matter of patient safety and undesired deterioration in patient outcomes. Ways of maintaining competence, once acquired, is both an educational and organizational challenge: we need efficient educational methodology paired with a locally implemented plan to succeed.

Devising a "Low-Dose High-Frequency" (LDHF) approach has shown superiority compared to regular courses based on bigger volumes of knowledge taught at longer time-intervals [3-8]. LDHF methodology has yielded very favorable results in both educational settings [4] and with professional healthcare providers [3-8].

Low-Dose High-Frequency



Niles et al. (2009) demonstrated that those who trained short-but-often needed less practice to regain mastery level of lifesaving skills [7]. Oerman et al.(2014) showed how the challenging skill of bag-mask ventilation improved significantly with LDHF compared to a control group [4]. Interestingly, Kurosawa et al. (2014) evidenced that dividing a regular course like the AHA PALS recertification course into smaller learning sessions, and contextualizing it through in-situ simulation, significantly improved the skill levels of pediatric and intensive care unit nurses and respiratory therapists in pediatric advanced life support [5].

Challenges

Scalability, Learning Data and Improved Patient Outcomes

Whereas simulator technology has developed considerably over the years, the same cannot be said for the pedagogical underpinnings and methods used to support simulation activities. Over time, simulation has come to be associated with a simulator, a facilitator and a small group of learners working on a clinical case. Sometimes there will also be an operator running the simulator from behind one-way mirrors.

But "simulation" is not one method. It is a word used to describe a whole array of methods. It may span from one person practicing a skill on his own, to a big operating theater with a cross-disciplinary team preparing themselves for a quintuple birth due to take place soon. And the main difference between these, from a simulation perspective, is not necessarily the number of people in the room, or the fidelity of the simulator, but rather the educational approach.

As an example, many simulations are never repeated until mastery level is reached. Constraints pertaining to available time, equipment or trained facilitators may all be perfectly good reasons why a scenario is done only once, with the follow-up debriefing. But from a psychological and pedagogical point of view, this approach may actually reduce the potential for learning. If participants are not given the immediate opportunity to practice what they have learned during the feedback and/or debriefing, competence and confidence will likely not develop to their full potential.

Hence, for much of the simulation currently ongoing, we argue that there are three main challenges:

- The lack of scalability.
- The lack of output data demonstrating mastery
- Improved patient outcomes.

The Lack of Scalability

In most educational contexts, and most certainly in the clinical domain, time, scheduling and resource constraints limit the amount of simulation everyone can participate in. Furthermore, reports point to the lack of trained faculty as the primary constraint to running more and better simulations both in educational institutions and in-situ in clinical settings [9].

The typical response to this challenge, today, has been to try to scale up the numbers of faculty or staff trained. Although this may help somewhat, it seems clear that this alone will not allow students and staff to practice until competent and confident.

The need for "synchronicity", being together at the same time and same place, also creates logistical challenges impairing the scalability of simulation.

Finally, the lack of standardized simulations ("scenarios") that may be run without an operator or even a facilitator present may be one of the biggest inhibitors for large-scale, effective and efficient implementations of simulation.

The Lack of Easily Available Output Data Demonstrating Compliance and Mastery

Motivational and learning theories advise that immediately after a simulation two things need to happen to see the desired improvement:

1. Feedback needs to be given about how one performed: further reflection upon the performance and feedback, typically called debriefing, is considered beneficial. However, this presupposes that the debriefing follows a structure that re-enforces and strengthens the new or adjusted neural connections and networks, the proof that learning did indeed happen.
2. Everyone should be allowed to use the feedback in a second (and third, fourth…) attempt at the same case. The purpose of this is to embody their learning from the feedback or debriefing and, thus, grow their self-efficacy and further strengthen the neural changes that are the basis for all lasting learning..

These points presuppose that readily available objective data pertaining to the individual and/or team performance are available. How can we establish that we have improved if we do not have a baseline?

To sum up

With the way simulation is implemented in many educational and clinical institutions today, the potential of this methodology is never truly realized. Resource and competency constraints are proven bottlenecks to scaling up simulation in demonstrating true value in compliance, mastery and, ultimately, improved patient outcomes.

What is Peer-to-Peer Education?

Practicing Together to Improve Clinical Competence and Confidence

At its simplest, Peer-to-Peer learning should be understood as an educational method where students or colleagues are learning from each other in a collaborative and safe learning environment.

Literature states that there are different models of Peer-to-Peer education. Peer teaching, near-peer teaching, peer learning, near-peer learning, peer tutoring, cooperative learning, peer assisted learning and reciprocal peer leaning are all terms used to describe variations within the Peer-to-Peer education concept. In some of these, the focus is on the tutor, in others the focus is on the tutee and some focus on both.

In this paper we focus primarily on the learner. But note, the learner can be both the one who receives feedback and the one giving feedback. Thus, Peer-to-Peer learning in this document is considered as "a flexible, learner-centered education methodology where students are practicing together to improve clinical competence and confidence". In this context peers may be of both same and different ages, or academic or professional levels.

User Groups

Healthcare Professionals and Students

User groups who will most likely benefit from Peer-to-Peer based simulation are both healthcare professionals and students. This methodology is best suited to academic cultures or work environments where there is openness towards learning, improvement and collaboration.

Examples include nursing and medical students working in dyads or triads in a skills lab to improve particular skills, or preparing for the National Council Licensure Examination (NCLEX) or Objective Structured Clinical Examinations (OSCE). It is a methodology that lends itself very well to use in a clinical setting where people come and go, but the physical location or space is fixed. A small room or a station set up behind a screen in a lunchroom could work very well. "Skill of the month" training based on previous mapping or on a clinical incidence is a way to make it relevant for all.

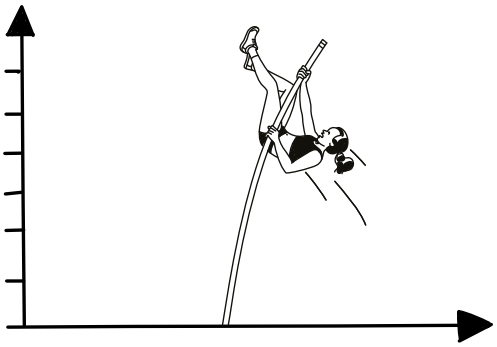
Emergency Medical Services (EMS) and Fire-Stations are also areas where Peer-to-Peer holds great potential for continuous learning and improvement. It may also be a very effective and efficient way to implement new equipment into a procedure or drill.

The Value of Peer-to-Peer in Simulation-Based Education

Scalability and Measure to Improve

Peer-to-Peer simulation addresses several of the challenges in the way simulation is implemented in both healthcare and educational institutions today. Allowing learners enough exposure to simulation to measurably improve both competence and confidence has proven to be a challenge for most. Peer-to-Peer-based simulation solves this by allowing learners to practice without the restrictions of available trained facilitators and the logistics of having to put together bigger groups.

While the facilitator may not be directly involved in each simulation session, his or her "presence" should be felt by ensuring that the scenarios used are constructed in a way that can give the learners objective "correct" answers and hints on how to improve, and to help their reflection on why they made the choices they did.



Finally, because the scenarios are constructed in a standardized, objectivized way, they also support "measure to improve", the ideal of any healthcare quality improvement activity. The data from each session is highly valuable for the learners to review their own performance. According to Hattie's research [10], reflection on one's own performance is the single most important factor that will positively impact future behaviour. The data may also be collected by the faculty or staff for targeted reporting on the improvements achieved.

What peer-to-peer might look like

Setting up a peer-to-peer simulation lab depends on your available resources. These resources include available lab areas, equipment needed for the scenarios, availability of relevant skill scenarios for peer-to-peer, and the potential need for students to access faculty and technical support. Using what is already available at any given organization should not be seen as a limitation, but as a unique opportunity to creatively and savvily use what you already have. The question to ask and focus on answering is: Based on what resources we have; how can we maximize our learners' experience of the peer-to-peer methodology?

Thus, we will not prescribe solutions or templates of what a peer-to-peer set up should look like. Rather, we take this opportunity to share two examples of what a peer-to-peer set up might look like. They are both inspired by what exist and what is being developed. To you, they are meant to elucidate what this can be, and to inspire you to think what it might be.

We'd like to note that the peer-to-peer methodology is suitable for students as well as professionals who need to rehearse and fresh up their skills.

Example 1

In a single room with three beds along one wall, and tables with task trainers along two of the other walls, students can enter at any time during extended working hours. In the room, along the fourth wall are different cabinets with all the needed equipment for the different skills to practice with. At the entrance there is a big drawer that contains all the scenarios – on paper – relevant for this room. At the entrance is also a logbook where students need to sign in. In the three beds you find three manikins of different kinds, one of them being a baby.

At all times, there is a technician available. This person may not help with skill and procedure related questions but can help when equipment is needed or out of function, or when students struggle with practicalities.

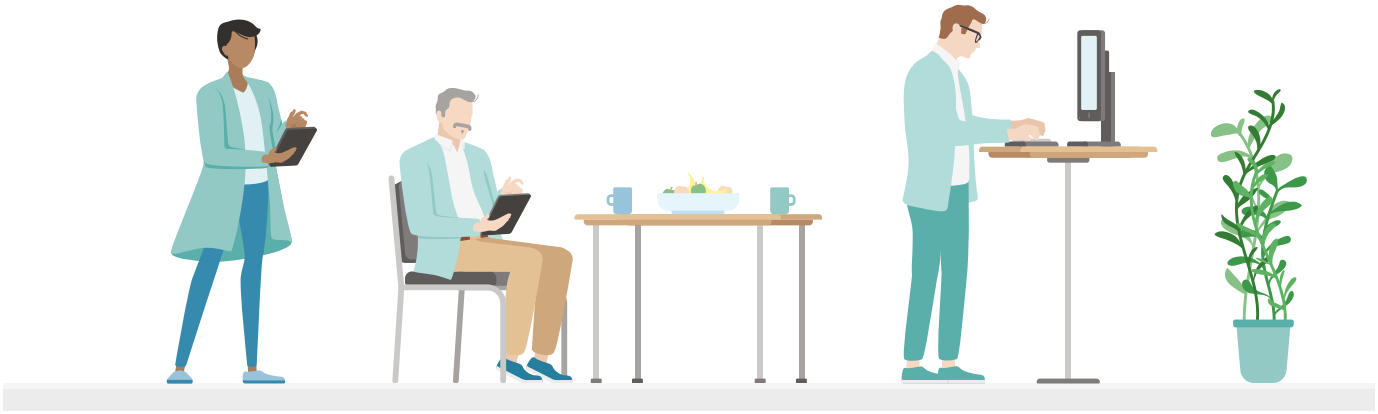
When students in small groups, from 2 to 4, enter, they sign in. They then pick up one of the skill scenarios to work with and gather at one of the group tables in the middle of the room to prepare for the scenario training. The paper check list includes a list of equipment to collect from the cabinets. When prepared, which may include studying relevant material beforehand, one

of the students will take the role as the learner and go through the skill. As the learner is going through the check list, one of the others in the group will check off the check list according to the learner's actions. During the training the students may discuss and clarify, or they may choose not to. This is a matter of choice for each group.

After the training is done, the group of students will go through the check list log, discuss what was done and discuss improvements before the same students take a second attempt on the same procedure to improve. Thereafter they will swap roles.

Example 2

Before a group of learners, from 3 to 4 persons, gather and meet up at the simulation lab, they prepare by logging into the peer-to-peer e-learning. The e-learning contains background information on how to work in a peer-to-peer setting. It shares knowledge on how to work in a safe learning environment, the different roles students may take on during training, and how to download the correct scenario to their smart phone.



On the day of training, they access the simulation lab by using a personal code. The lab can host up to ten groups at the time. In one room, a single faculty member is available to help with upcoming questions. Thus, one teacher can observe and facilitate 30-40 students at one time.

On their smartphones, the attendees can access relevant video demos for the procedure to work with, and before they start, they all do. Thereafter they collect the equipment and then divide into the three different roles: the learner, the operator and the observer(s).

The operator picks the correct scenario from a list on their smartphone and adds the learner's student ID as the user. They are ready to go. During the procedure the operator only uses the check list to check off what is done. Every now and then – based on the given task and check box – a question appears on the screen to be discussed in the group. They can discuss it immediately or agree to go through it in more detail later during the feedback session. When the learner is done, the group gathers to go through the feedback log on the operator's smartphone and discuss it. This log shows all the steps that were done, in what order, and all the pop-up questions that had appeared. In addition, since the operator added the learner's student ID as the user, the learner can access their own smartphone to see their progression on the given skill, and all other skills they have trained on. Thus, each learner can see their own progress.

After the feedback session, the learner does the same procedure again, based on the feedback, and can see immediate improvement. The students swap roles and take new rounds with the given skill or another one.

Because this digital solution is always logging individual progress, this solution is also used by the school to track overall progress and to check off the students for mandatory procedure assessments. In addition, the faculty have access to the cohort statistics, giving them an idea of what students struggle with and thus where to improve the teaching and demoing in class.

Pedagogical Underpinnings

A Brief Introduction

Pedagogy is a pluralistic discipline where a set of learning theories are used to describe and support educational methodologies. Having support from several learning theories for a given educational method helps us to understand, describe, develop and implement that given methodology's full potential. Thus, by creating a backbone of different learning theories that support the Peer-to-Peer education methodology, we can better understand its potential and value for simulation. Digging deep into pedagogical theories is not the aim of this text, but rather to give a brief introduction to some theories constructing the main backbone of Peer-to-Peer education in simulation.

Experiential Learning - the value of experience and reflection

Experiential learning is based in the concept that knowledge is gained through personal as well as environmental experiences. It is also described as a theory of learning through reflection and doing. The learners need to be able to reflect on their experience, conceptualize it through analytic skills and ultimately be able to use their experience to make decisions and solve challenges. The learners play an active role in their own learning. At the core of this theory is Kolb's learning cycle.

Situated Learning - the value of context

In situated learning, learning is described as a social process where knowledge is co-constructed and, where learning is situated in a specific context and embedded within a given social and physical environment. A critical point is that learning should take place in the same context as it is applied.

Mastery Learning - the value of observable competence and confidence

In mastery learning, the focus is that the learner must master a given basic level before entering a higher level of their learning journey. If the learners do not master a given skill, they will receive additional support until they master that given level. Thus, time is a critical factor. This educational philosophy underlines the need and value that the time required for master, will differ among the learners and focus should be put on competency rather than compliance.

Radical Behaviourism
- the value of clear and structured feedback

The idea of radical behaviourism, i.e. the stimuli-response interaction, is logically connected to the concept of feedback. Constructive and unambigous feedback aid in changing behaviour. In leading a desired change in behaviour, this kind of feedback should be kept neutral and with clear references to a set of guidelines, best practices, standard operating procedures, or similar.

Social Constructivism
- the value of learning in groups

Social constructivism is a fraction of the bigger philosophical and psychological theory of constructivism. It focuses on how the learner actively creates knowledge by experience. The Socio-Constructivistic perspective puts emphasis on each learner seeing themselves as part of a larger, social entity, and that the output from learning is strengthened by learning together.

Self-Directed Learning
- the value of learning at one's own pace

Self-directed learning is in its most basic form founded on the idea that learners possess the capacity and motivation to be self-directed. The motivation comes from curiosity, satisfaction of accomplishments and the desire and need to achieve. Also, the idea of self-directed learning presumes that learners mature differently and thus need to learn at an individual pace.

Deliberate Practice
- the value of strategic rehearsal

The essence of deliberate practice is to improve the current level of performance through repetitive actions. Keys to achieve this are through motivation, pre-existing knowledge, immediate feedback and knowledge of one's performance. Through this, the learner should repeatedly perform the task [11]. Deliberate practice is well acknowledged to have a major role in best practices of health education simulation and is thoroughly described elsewhere [12-13].

To sum up

The infographic illustrates how different learning theories support the Peer-to-Peer education methodology. They all nurture different aspects of the Peer-to-Peer concept, where the learners are working in smaller groups, rehearsing on given procedures or skills; and where internal motivation, individual pace, learning capacity and previous experience is critical for the learning outcome. It also highlights, where the learning contexts and well-structured feedback are key for learning success. Peer-to-Peer therefore holds the promise of creating a learning environment where many of the known theories of learning are supportive.

Peer-to-Peer Research

This text aims to give the reader an update on the most recent research of Peer-to-Peer in health education. In a review article published in 2016, Martin Stigmar was looking at the evidence of Peer-to-Peer in cross-disciplinary academia. One of his conclusions was that even though academic achievements may not be improved specifically, generic skills development and metacognitive training benefit from Peer-to-Peer education [14]. This includes learning autonomy, learning motivation, collaborative and communicative skills and critical thinking.

> *Generic skills development and metacognitive training benefit from Peer-to-Peer education (Stigmar, 2009)*

In their 2013 study, Stone et al. [15] screened over 1800 studies and ended up with 18 studies describing undergraduate nursing students. The report included qualitative, quantitative and mixed methods approaches. This review showed that of the 18 studies, 16 demonstrated positive outcomes of Peer-to-Peer education. Among the outcomes were increased levels of knowledge in areas of problem solving and communication, improvements in critical thinking, and cognitive and motoric skills. In addition, students gained confidence as well as decreased anxiety [15].

> *At a time when there is pressure to train more nurses and minimize costs, peer learning could utilize resources more effectively with students teaching and supervising more junior students, thus decreasing the demand on the responsible faculty members" (Stone et al., 2013)*

Interestingly, the authors accentuated that, "At a time when there is pressure to train more nurses and minimize costs, peer learning could utilize resources more effectively with students teaching and supervising more junior students, thus decreasing the demand on the responsible faculty members" and, "Peer learning may also be more successful when peers are close in experience or stage of training as it provides a more relaxed, less intimidating, more "user friendly" learning experience than sessions conducted by registered nurses." [15].

In a study of 2017, Pålsson and co-workers [16] investigated the effect of peer-learning in clinical practice education of student nurses. Whereas the control group was always tutored by the faculty, the intervention group was first tutored by faculty for two weeks, then for the latter two weeks students worked as peers and guided each other with the faculty observing and clarifying patients' interventions. The interesting results showed that whereas the controls improved on 4 of 20 assessed tests, the Peer-to-Peer group improved on 13 of the 20 tests [16]. Yet, the difference between the control group and Peer-to-Peer groups was only significantly different on one of these tests: the nursing self-efficacy score. Even though one cannot state that the Peer-to-Peer group did better than the control, this research shows that they did at least as well as. Thus, together with other research one can question whether the need for faculty present during simulation is always beneficial or critical. Supporting this is a report covering emergency medicine students where the intervention group was led by a peer and the control by a physician [17]. Both groups improved, and both groups scored the same in the pre- and post-test. Thus, Peer-to-Peer seems to have the potential to be just as effective as more traditional education. In a review article, also from 2017, Gazula et al. [18] studied mostly medical and physiotherapy students. The results from this review also showed positive outcomes of a reciprocal Peer-to-Peer approach. They found that metacognition, cooperation and communication skills were enhanced, and also that knowledge and skills were improved; retention of the subject matter topics enhanced; and even course grades improved [18]. In another review from 2016, Williams and Reddy found, though not unambiguously, that OSCEs were improved both for the peer teacher and student [19]. One of their take homes was that "... PAL in tertiary healthcare is effective in practical training but may not be as beneficial in theory learning" where PAL refers to peer-assisted learning.

> *... PAL in tertiary healthcare is effective in practical training but may not be as beneficial in theory learning*
> *(Williams and Reddy, 2016)*

Even though one cannot conclusively say that the Peer-to-Peer approach in education always improves the learning outcomes compared to more traditional education models, Peer-to-Peer has a great potential to at least do the same job as traditional education. In a world where education models are challenged by a need to educate more health care workers, newly educated health workers lack basic clinical skills , and there are wider concerns with medical errors and patient safety, Peer-to-Peer education might be one of several sustainable solutions.

To sum up

We refer to John Hattie who states: *"The remarkable feature of the evidence is that the biggest effects on student learning occur when teachers become learners of their own teaching, and when students become their own teachers"*. Hattie, 2009 (p.22)

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