

PRACTICE GUIDELINES

A form of mental simulation with significant enhancements enabling teamwork training

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ABSTRACT

Mental simulation is a type of simulation in which the clinician mentally practices a task without physically doing it. With mental simulation, the clinician can individually go through all the steps of technical and behavioural skills, such as decision-making skills, that they would apply in a particular situation. However, since this activity is individual-based, it does not lend itself to practising interprofessional or team-working skills. Moreover, users of this approach cannot get feedback from their colleagues or educators. Therefore, we claim that an interactive mental simulation approach using the representation of a patient and equipment combined with thinking aloud could help to rehearse behavioural skills in a classroom-based environment with other team members but without the need for a manikin or advance simulation suits. We call this approach Visually Enhanced Mental Simulation (VEMS). VEMS can also be delivered remotely using online platforms while addressing the same learning objectives.

In this article, it is argued that VEMS can be an interactive way of undertaking a simulation-based activity with limited resources yet in a very interactive manner to engage a team of learners from the same or different professions. Explanations regarding how it can be delivered face-to-face, as well as using an online platform, are provided.

Background

Mental simulation has been used as a warm-up exercise in many fields, including sports and music, and it has been found that mental simulation improves performance^[1] especially if it is done before the activity as a form of cognitive practice^[2]. Mental simulation has been defined as rehearsing the skills mentally to practise them^[3]. It has been also utilized as a simulation practice in healthcare. Mental simulation has been studied broadly regarding technical skills such as epidural catheterization^[4], laparoscopic skills^[5,6] and other areas^[7], as well as behavioural skills such as management^[8] and decision-making skills^[9]. Mental simulation works similarly on the brain as the active observation of a task. That is because both activities stimulate a similar part of the brain related to motor skills^[6].

However, mental simulation approaches generally used involve an individual task in which practitioners follow written steps and rehearse the actions or processes of care in their mind. It can be argued that if this approach is supported by visual elements, it supports cognitive activity and stimulates thought processes. Therefore, external visual elements can enable group learning^[10]. Yet, mental simulation cannot be observed, as it occurs in the minds of the learners, by educators and other participants if it is intended to be facilitated interactively. Therefore, it does not lend itself to practising interprofessional or teamworking skills. Users of this approach cannot get feedback from their colleagues or educators. Therefore, educators need access to participants' imagination. One strategy to enabling access is 'think-aloud'.

Think-aloud is someone's action of saying out loud the thoughts they have in their mind^[11]. This method has been used for data gathering and for understanding the thought processes and problem-solving strategies of healthcare practitioners^[12-14]. This method can be integrated into simulation sessions so that the participants' decision-making processes can be practised and examined in a safe environment.

We argue that if the mental simulation approach is supplemented with think-aloud, a patient poster 'animated' by a facilitator and equipment vignettes, it can enable participants to go through a complete scenario as a team in an interactive environment. We have called this approach 'Visually Enhanced Mental Simulation' (VEMS). The aim of this article is to present how VEMS can be applied in face-to-face and online environments.

What is VEMS?

VEMS was developed by Alinier et al^[15] in Qatar for paramedic participants to demonstrate their decision-making and cognitive skills. It is a combination of mental simulation and think-aloud with external representations of a patient and the treatments applied by the participants. It differs from the mental simulation which solely occurs in the minds of participants because they are expected to collectively verbalize their thinking and actions, including equipment setting and communication with the patient.

What are the visual elements of a VEMS session?

In VEMS, visual representations such as a laminated patient poster and equipment (IV catheter, IV fluid, ECG monitor ...) or props (wounds, dressings ...) vignettes are used to support cognitive activity and increase imagination^[10]. The patient poster should be large enough to be seen by all participants and observers and it should also be able to accommodate the equipment which is used in the scenario. Using a laminated poster enables the facilitator or participants to easily draw onto the patient with an erasable marker pen. Moreover, because of the lamination, the poster is more durable and can be cleaned to be reused multiple times.

Another reusable visual element of VEMS is the set of equipment vignettes and props. These vignettes should represent key elements of patient care such as different models of oxygen masks, the intravenous cannula of various sizes, electrocardiogram electrodes, blood pressure cuff and physiological monitoring devices. Some might be present on the poster right from the beginning of the scenario because of the current condition of the patient, while the others can be placed on the patient poster by the participants or the facilitator during the scenario. They should be of an appropriate size to fit the patient on the poster and help increase thought processes (Figure 1).

Moreover, a whiteboard or a flipchart is used to write down the patient's physiological parameters when asked by the participants and based on the applied monitoring equipment. This corresponds to the parameters shown on a patient monitor during a full-scale scenario. For example, when a participant thinks-aloud as 'I am getting the blood pressure'

and has applied the blood pressure cuff equipment vignette on the patient's arm, the blood pressure value is written on the whiteboard. Meanwhile, the facilitator also writes down all actions undertaken by the participants at the indicated time. Therefore, all of these visuals help participants and observers to see the patient's condition and the actions taken while mentally engaging them in the next steps to take in the scenario.

How VEMS is applied as a simulation modality

VEMS are developed like other simulation activities around well thought-out learning objectives^[16] and are facilitated in a similar way to an immersive scenario-based full-scale simulation. Furthermore, VEMS and scenario-based full-scale simulation enable participants to practise skills in a safe environment. As in scenario-based full-scale simulation, VEMS also can be used for healthcare professions' training and interprofessional education. Both simulation modalities include pre-briefing to introduce the participants to the simulation environment, orient them to the equipment and resources and explain how they are expected to behave and engage in the activity. Participants are expected to actively participate in the scenario and consider the patient case as they would do in a real clinical environment. Once the facilitator brings the scenario to an end, it is followed by the debriefing to discuss in detail with the participants how they managed the case. However, with VEMS, the most appropriate scenarios are those that do not concentrate on technical, psychomotor or procedural skills as observable learning outcomes. It can, for example, be used with scenarios related to behavioural skills such as decision-making, teamworking and communication skills. As in scenario-based full-scale simulation, VEMS requires some advance preparation and setting up on the part of the facilitator. For example, the facilitator should consult the scenario script to verify what props or equipment vignettes should be placed on the patient poster before the start of the scenario and what should be available during the scenario^[17]. Based on our experience, the pre-scenario phases play an important role in the smooth facilitation of the scenario and the subsequent debriefing so participants engage in the activity as intended^[18 p7]. Participants should be informed of the timing of the session and how many scenarios will be run. Explaining the general ground rules of the simulation session, orienting participants to the VEMS environment and discussing the expectations will help them engage in the activity as expected. Participants should be informed that their patient is the poster and that they should place the equipment vignettes on the poster to illustrate their actions. This is particularly important in instances when participants join the action at different points in time during the scenario^[17]. It needs to be clear to the participants that they will not be expected to perform anything technical, but they should clearly verbalize their actions and place the corresponding vignettes on the poster, and that parameters will be provided by the facilitator based on what monitoring they see applied to the patient poster. Before the scenario commences, a short live or video-recorded demonstration could be shown to participants to clearly demonstrate how VEMS works. Participants may

Figure 1: An example of the patient poster, equipment vignettes and props

perform in front of a classroom with their peers observing and involved in the debriefing.

Depending on the scenario or curriculum requirements, the participants may be from the same or a mixed range of professions, as would be the case in a scenario-based full-scale simulation. Other learners may be observing the scenario from the same room or remotely if there is an audio-visual system installation to enable this. Participants are expected to interact with the patient poster by communicating with them and placing the equipment vignettes they use on the patient while verbalizing their actions. The facilitator verbalizes the patient's voice and provides the physiological parameters on the whiteboard when measured or requested by participants, and notes their decisions and interventions with the time. The facilitator or an assistant may have to place the equipment vignettes on the poster if this is not done by the participants. If the scenario includes other actors, another facilitator may have to take that acting role, and this should have been clarified as part of the session pre-briefing.

Facilitators preferably do not guide the participants but facilitate the scenario, as is the case in most immersive scenario-based full-scale simulation, and so it does not become a case discussion. Immersive scenarios prepared for behavioural skills training such as decision-making, communication and management skills can be utilized in VEMS sessions. If some particular skills need to be

demonstrated by learners, it is possible to facilitate it in a hybrid manner whereby participants could be asked to perform specific procedures on a part-tasked trainer after they verbalized them during the scenario.

The duration of a scenario depends on what is expected from the participants. As there is generally no real equipment used and no technical tasks to perform in this modality, since participants only stick the vignettes on the patient poster as they verbalize their actions, the duration of a scenario can be slightly shorter than if it was run as a scenario-based full-scale simulation. However, it is recommended to allow for the debriefing to last about three times the duration of the scenario ^[19]. The session needs to be designed as per the group's needs and it should preferably relate to their previous learning and clinical practice experience ^[20]. The complexity of the task can be based on the level of experience of the target group of participants. Uncomplicated scenarios can be delivered to novice practitioners and more complex scenarios can be facilitated for more senior practitioners.

The debriefing is facilitated in a similar way to a scenario-based full-scale simulation debriefing. The debriefing model can be determined by the facilitator and should be conducted just after the scenario without giving any break to prevent learning loss ^[18 p14]. Debriefing methods such as Plus-Delta ^[21], Promoting Excellence And Reflective Learning in Simulation (PEARLS) ^[22] and Good Judgement Debriefing ^[23] can all be used following VEMS.

To whom does VEMS apply?

VEMS can be used for behavioural skills training for uniprofessional groups of participants such as nurses, midwives, paramedics, doctors etc. as well as for interprofessional education and team training. It is applicable to healthcare learners from all disciplines who need to enhance their behavioural and decision-making skills and who would be invited to an immersive scenario-based full-scale simulation session. However, there will be a much lower focus on technical or psychomotor skills during VEMS sessions. It may involve undergraduate students or qualified healthcare professionals. VEMS can be integrated into healthcare training more easily than scenario-based full-scale simulation due to the ease of applicability.

What are the advantages and barriers of VEMS?

VEMS could be considered as a potential alternative or complementary approach to scenario-based full-scale simulation because it is facilitated in a similar way but without the risk of technological failure during a scenario and the need for expertise to operate it. Moreover, scenario scripts developed for scenario-based simulation sessions can be used for VEMS, so educators can easily implement VEMS using existing educational resources [15].

Mental simulation and think-aloud techniques stimulate participants' critical thinking abilities, so an engaging and cognitively effective activity could enable efficient learning with VEMS. However, unlike mental simulation which can be used in cognitive and psychomotor skills development, VEMS does not really apply to practical skills development due to its operating method, unless it is combined with another modality (e.g. part-task trainer) as a hybrid simulation session. In VEMS, participants are not pushed to concentrate and mentally visualize how they would perform a psychomotor skill in a VEMS session as would be the case in purely mental simulation, but they are asked to visualize and think-aloud the process of their practice and their patient management. However, scenario-based full-scale simulation sessions can be used for both practical and cognitive skills practice as purely mental simulation.

As any simulation activity needs to be well planned in order to sustain an effective learning activity, VEMS also needs a proper facilitative approach and good planning. First, it is essential that the facilitators are supportive and encouraging [24]. Pre-briefing about the learning activity to inform participants about the limitations of the simulation, the technology and the expectations of their behaviour will help them to engage more realistically in the activity [18 p6]. Moreover, the cues and information about the scenario need to be adequate and structured without giving away the scenario, if that is appropriate for the level of the participants [24]. For this, the visual representations need to be used properly and concurrently with participants' think-aloud. A structured plan enables dealing with the complex nature of the simulation and briefing/debriefing, and sustains an 'action phase of experiential learning' [24 p165]. Another factor for an effective

simulation is a safe environment [24] which can be easily sustained with VEMS due to its low-scale nature without technological burdens and the fact it can be used in any environment.

Furthermore, with VEMS, students may find it difficult to communicate with the poster or find it odd to talk with the actor (the facilitator vocalizing the patient) and apply interventions to the poster. Nevertheless, students may find this method helpful to practise their skills.

How can VEMS be facilitated remotely?

In the line that special circumstances push for innovative educational approaches, VEMS can also be run remotely for physically dispersed learners using any online teleconferencing platform. Online VEMS should allow addressing similar learning objectives (e.g. decision-making, critical thinking, communication ...) for a limited number of learners actively engaged in the scenario and with an unlimited number of observers.

The remote version of VEMS can be delivered using the screen-share function of video teleconferencing platforms such as Zoom, MS Teams, WebEx, Skype or GoToMeeting. It can be facilitated using PowerPoint and Word in place of the patient poster and whiteboard, with drawings or images as equipment vignettes, or simply the facilitator's web camera facing a noticeboard with the standard VEMS resources. PowerPoint can be utilized to present the patient poster and equipment vignettes as images. The equipment images should preferably have a transparent background to easily apply onto the patient image. On the same screen, Word can be shared beside the PowerPoint slide to write down the patient parameters and participants' actions. The facilitator can vocalize the voice of the patient and animate the equipment pictures as their use is verbalized by the participants. As with the original VEMS, two or three people engage in the case scenario as other session attendees quietly observe from wherever they are. Online VEMS allows addressing similar learning objectives (e.g. decision-making, critical thinking, communication ...) as in its original form. As opposed to the classroom based VEMS, unlimited people can participate in an online VEMS session as observers and then can contribute to the debriefing session. Although the effectiveness of remote VEMS has not been studied yet, there is a huge potential that it can provide a rehearsal environment in healthcare education on online platforms.

Conclusion

VEMS is a very engaging low-cost simulation modality as in its most basic form the only required resources are a laminated patient poster, equipment and props vignettes, a whiteboard and marker pens, any available space and experienced facilitators with relevant scenarios. Since VEMS puts less pressure on equipment resources and the engagement of the participants could be similar to what they would experience in a scenario-based full-scale simulation, it can provide a viable approach for observing interprofessional team dynamics and participants' decision-making skills. The online version of VEMS also can

be an engaging learning activity that enables practising behavioural and teamworking skills while participants and facilitators are physically distanced.

Declarations

Authors' contributions

BD wrote the manuscript in consultation with NP and GA; GA conceived the original idea; NP and GA supervised the project.

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