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Title:
Managing Student Workload in Clinical Simulation: A Mindfulness-Based Intervention

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Contributor Statement

LM-C initiated the idea of using mindfulness strategies as a strategy to reduce workload, CP assisted the research design development and data analysis , SC lead the electronic data collection, LM-C, MM, CP, SC and CS all implemented the research protocols. All authors contributed to the writing, reviewing and editing the manuscript. The guarantors of the work are CP and LM-C.

Conflict of Interest Statement

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Abstract:

Background: Simulation places multiple simultaneous demands on participants. It is well documented in the literature that many participants feel performance stress, anxiety or other emotions while participating in simulation activities. These feelings and other stressors or distractions may impact participant ability to engage in simulation. The use of mindfulness has been proven to enhance performance in other contexts and we wondered if including a mindful moments activity in the traditional pre-brief would change the participants perceived workload demands.

Method: Utilizing a 4th year undergraduate nursing course with intense simulation requirement we were able to compare a control group to an intervention group who was exposed to this mindful moment activity. All participants completed the same simulations. Post-simulation event, all participants completed the National Aeronautics and Space Administration Task Learning Index which measures mental demands, physical demands, temporal demands, effort, performance and frustration. Our convenience sample consisted of 107 nursing students (86 treatment group, 21 control group) who participated in 411simulations for this study.

Results: The control group experienced significantly different perceived workload demands in two domains (temporal and effort).

Conclusion: It is possible to manipulate participants' perceived workload in simulation learning experiences. More research is needed to determine optimal participant demand levels. We continue in our practices to utilize this technique and are currently expanding it to use in other high stress situations such as before exams.

What this paper adds:

While it is well known in the literature and in practice that simulation places many workload demands (intended and unintended) on participants it was not known if these demands could be manipulated. Based upon this study we demonstrated workload can be manipulated, in this case by a mindfulness technique in the pre-brief activity of lab. We also identified that educator awareness of elements of participants perceived workload demands (mental, physical, temporal and demands of effort, frustration and performance) on participants can aide in curricular evaluation and design.

Introduction & Background

Strong instructional design guided by the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice assists educators to develop powerful simulated learning experiences.[1,2] During simulated clinical activities, participants are asked to engage in behaviours that are outside of their comfort level which in turn can generate disorienting dilemmas.[3] A disorienting dilemma occurs when individuals face a crisis or major transitional experience that can serve as the impetus for meaningful learning to occur.[4] Through critical reflection and rational dialogue in debriefing, disorienting dilemmas serve as catalysts that spark participant curiosity about theirs and others' cognitive frames, actions, and personal values. Once participants have either reaffirmed or reframed their beliefs, assumptions and values within a given situation, they are better positioned to integrate new learning into their personal framework.[3,4] When applying Mezirow's Transformative Learning Theory to practice, it is important for facilitators to optimize the balance between challenging participants while ensuring they feel safe to experiment and learn.[3] Facilitation, one aspect of robust simulation design, requires the use of methods such as preparatory activities and pre-briefing before the simulation-based experience.[2] One of the goals in facilitating simulation learning is to create an environment in which participants feel safe and supported yet challenged enough to promote learning. This goal is consistent with pedagogical transformative learning approaches that expose participants to disorienting dilemmas.

Interestingly, simulationists have identified that participants face a significant amount of strain during simulated learning activities.[5] During simulations, participants often appear to be using

a significant amount of energy/workload to manage the stress of simulated clinical performance. Students' energy can focus on managing anxiety and on the worries of coping and performing in front of peers, rather than on the learning opportunities. In fact, within each simulated learning activity participants experience multidimensional demands. These demands are mental, physical, temporal, performance, effort, and frustration.[6] Workload is the term used to describe the cumulative experience of these demands.

Workload is a subjective experience of the learner. Workload demands, either too high or too low, interfere with the processing of information and decrease the effectiveness of the learning.[7,8] The National Aeronautics and Space Administration (NASA) developed a Task Load Index Survey (TLX) to identify the magnitude and sources of six workload related factors.[6,9] The NASA-TLX 68 tool assesses self-reported perceptions of workload in the domains of 1) mental demand, 2) physical demand, 3) temporal demand, 4) performance, 5) effort, and 6) frustration. Initially, this tool was used by NASA in the aviation and transportation sectors.[10] Subsequently, diverse disciplines such as business, psychology, engineering, medicine, and nursing have also employed the tool.

Even with well-designed and deployed simulations, participants report and demonstrate tense or anxious behavior before and during simulation labs.[4,11] Thus, exposure to a disorienting dilemma in a simulation is likely to increase workload demands that participants experience. Many factors contribute to an effective clinical simulation learning experience including situational awareness.[5] To have situational awareness participants must accurately interpret external data from the patient, team, and environmental variables. Also, they must do so while

managing mental, physical, temporal, and performance demands that confound the participants' ability to focus. To fully engage in the simulated learning experience participants are required to be situationally aware, self-aware, and present and responsive to others in the moment. High perceived workload levels during simulation learning events, therefore, can contribute to suboptimal learning outcomes. It is that learners adopt and implement personal coping strategies to mitigate the effects of workload on clinical practice.

Mindfulness is the act of bringing awareness to ourselves and our place in the world, a significant factor of situational awareness. It is "waking up" to the present moment and being in touch with it.[12] Mindfulness has been effectively used to improve awareness and decrease stress.[13] The authors hypothesized that using mindfulness during pre-briefing helps to create an environment in which participants feel safer and less stressed, thus allowing for increased focus when encountering disorienting dilemmas thereby facilitating transformative learning. A systematic review of mindfulness-based interventions and identified several positive effects within a school-based setting including reduced stress and situational awareness.[14] Evidence of similar work was not found within post-secondary institutions. This study bridges that gap in current knowledge by studying mindfulness in simulation with post-secondary nursing students.

The purpose of our study was to quantify participants' perceived workload for each domain within the NASA-TLX and use those scores to explore the following questions: a) Which elements of workload were being stressed the most in each of the simulations? b) Would a mindfulness-based intervention alter participants' perceived workload demands? c) Would a mindfulness-based intervention decreases participants' perceived workload demands within a simulation? Institutional research ethics board approval was obtained before the study.

Research Design

Our study participants were 4th year nursing students within a mid-sized Canadian university enrolled in a senior clinical nursing course in the last semester of their program. Learning objectives for this course focused on the consolidation of knowledge and skills related to professional roles and influencing care. There are four simulations embedded in the course which look primarily at leadership and followership skills, team work, and difficult conversations with patients, families and team members. In all, 107 participants consented to participate in this research project.

The convenience sample was divided into treatment and control groups following instructor willingness to allow researchers into class to present an information session to their students. Participation in the research project was not mandatory and did not affect the student's grade. All students in the intervention groups were introduced to the mindfulness technique. Those who chose not to participate were asked to sit quietly so that classmates who were participating were not disturbed. Researchers provided an information session and left an information consent letter for all potential participants. Students agreeing to be research participants indicated their consent on every survey they completed to indicate their ongoing consent. Out of a potential sample population size of 120 students 107 (89%) consented and took part in the research process. Eighty-six participants were assigned to the treatment group, while 21 participants were in the control group. Cumulatively, these participants were involved in 411 simulation experience responses.

Methods

The simulated clinical activities within this course were designed to align with the educational preparation and learning needs of the participants, consistent with the second criterion of INACSL Standards. [1,2] The course comprised a total of 15 lab hours with 5 different 3-hour clinical simulated activities. The simulated clinical activities were used to facilitate participant integration of theory and knowledge related to nursing practice, ethics, leadership/followership, complexity science, and healthcare system trends. For the purposes of this study we exposed students late into their undergraduate education to this form of mindfulness. We did this due to our observation of the need for it at this point in time, however one might suppose it would have more effect if introduced earlier in an educational program which could allow for more strategies and more usage. Other health-care programs, such as those delivered by Duke University, Georgetown University, McGill University and the University of Rochester have mindfulness embedded throughout their medical degrees.

The treatment group engaged in a guided 2-minute mindfulness-based intervention embedded in the pre-brief component of the simulation. This preparatory action became known as the "Mindfulness Moment." Faculty members led the control group and facilitated the simulated clinical activities. To ensure standardized implementation of the mindfulness-based interventions, a qualified mindfulness practitioner provided training sessions for all facilitators within the treatment group with scripts provided for each mindfulness-based intervention. The scripts varied weekly and targeted a different body sensation (e.g., hearing, touching, smelling, or tasting) to facilitate building greater awareness of self and space they occupy in the world. Table 1.1 provides an example of one of the mindfulness-based interventions which focused on

hearing.

Table 1.1

You are invited to do this exercise with eyes open or eyes closed. If you leave your eyes open, please lower your gaze. If I ask any questions during this exercise, they are meant to guide your attention – no verbal answer is required. Bring your attention to your breath. (*Pause*) Notice the inhalation and notice the exhalation. *(Pause*) Notice the feel of the breath as it enters your nose and then notice the breath as it leaves your nose. (*pause*) Notice the rhythm of your breath. Is it fast, slow, even, rough? (pause) Is there a pause between the inhalation and the exhalation, or between the exhalation and the inhalation, or is the breath happening without a pause? How is your breath today? Let your attention shift to your body sensations. Today, notice what you are hearing *(pause*). What sounds call your attention? (*pause*) What sounds are close to you? (*pause*) Which sounds are far away? (*pause*) Keeping your attention on your hearing, notice what you hear in the next minute of silence. (*1 minute of silence*) *(quietly…)* Now bring your attention back to your breath. In your own time, take two deep breaths, open your eyes, and bring your attention back to the room and prepare yourself for participating in lab.

After completing the mindfulness-based intervention, the treatment group participants progressed through the simulation. After simulation debriefing, both treatment and control group participants were given ten minutes to complete the NASA-TLX. Typically survey completion took two minutes.

Results

One-hundred and seven participants completed the NASA-TLX survey post simulated clinical activities. The measure consisted of six, 10-point Likert scale questions, that assessed perceived workload demand in the areas of mental demand, physical demand, temporal demand, performance, effort, and frustration. Non-paired t-tests were used to analyze survey results. Readers should exercise caution when interpreting these results. What we have determined is that workload is manipulatable by mindfulness activity. Data analysis provided useful information and notable unanticipated findings. It is important to note that mindfulness-based interventions did not target any particular workload domain. However, the treatment group reported significantly lower levels in temporal workload and higher levels of effort.

Mental and Physical Demands Subscale. Participants reported experiencing low physical demands and, moderate to high mental demands. This finding was not surprising given the complex and intensive nature of the scenarios. Scenarios required participants to engage in substantive planning prior to the event, and then to focus and pay attention during the simulation. We observed that commonly simulationists and participants both concentrated more on physical aspects of the scenario, such as the props, the equipment, the layout, and the fictional contract rather than on the mental demands such as the clinical judgement activities and thought processes participants will work through.

Temporal Demands Subscale. Temporal demands, also interpreted as time pressure, were significantly influenced by mindfulness activities, with participants in the control group reporting a statistically significant ($p<0.05$) higher level of temporal demand than participants exposed to

the mindfulness intervention.

Effort Subscale. Effort was another workload demand which asks for participants to identify on the scale of 1-10 how much effort they put into the simulation or task being studied. In our study these measurements proved statistically significant with a difference of ($p<0.01$) was revealed between the control and intervention group, where higher levels of effort in those that participated in the mindfulness intervention. Overall self-181 reported effort was moderate to high for the majority of participants.

Performance Subscale. Performance refers to the participants self-perception of how well they performed in the task or simulation. In our study responses spanned from low to high, with most participants reporting moderate range performance demands.

Frustration Subscale. Analysis of this NASA-TLX component revealed that participants experienced unexpected higher levels of frustration in some simulations. Perceived frustration levels were not reported as we anticipated them to be, for an example, in one of the simulations we purposely expose students to a frustrating situation yet the self-reported scores here were not as high as we anticipated. Conversely, in another simulation where we did not build in a frustration element, participants reported higher levels of frustration then we anticipated or visually saw in the simulations and debriefs which allowed us to know frustration might be a hidden element of workload within simulations. Specific frustration levels in our simulations allowed us to tailor the simulation activities to optimize frustration levels in support of learning.

We did notice anecdotally that even with a 5-week progression of this technique students became more adept at shifting themselves in and being ready for the activity. Faculty noticed that students were calm, focused, and demonstrated a higher sense of self-efficacy in managing the simulated scenarios and during the debriefing activities. We also heard from some students that they incorporated mindfulness strategies into other parts of their lives. These included higher stress situations such as before exams, before a clinical experience, and before simulations or laboratory experiences.

Further Discussion

The results suggest that the use of a preparatory mindfulness-based intervention can manipulate participant workload demands during simulation learning experiences. The impact on participant learning was so significant that facilitators continue to use the "Mindful Moments" to prepare students for simulation learning activities. There is strong evidence to suggest that student engagement increases student success. [15,16] It is critical to continue to identify means of decreasing the energy participants expend on demands not directly linked to the intended learning goals. A notable number of participants rated themselves low in the performance domain, which was unexpected. Since this course is during the final semester of a baccalaureate degree, the low levels of performance ranking would be necessary to investigate further to answer questions such as why do they view their performance so poorly when so close to the end of their education? What factors impact their perception of their performance?

An unexpected finding of this study was the utility of the NASA-TLX results for scenario design, curricular evaluation and quality improvement. This survey took only minutes for participants to complete and yet provided a wealth of information regarding workload demand

perceptions. Often when designing and operating simulations educators must "go with their gut." Following data analysis, revisions were made and are ongoing as we aim for optimal workloads for each simulated clinical activity. Future research could determine the optimal level in each workload domain to maximize learning. Because of the ease of use and effectiveness of this evaluation tool, we have utilized it in other courses and simulations to improve insight and inform curricular revisions.

Simulation is meant to mimic clinical practice. There is potential value of the use of a mindful moment as preparation in clinical practice in a variety of contexts: before admitting a trauma patient, before completing an intense nursing or medical intervention, before having a difficult conversation as some examples. Just as the simulation environment and our course context place many competing demands and priorities on the participants, so does clinical practice. We would suggest the integration of mindful moments into practice in our newly graduated nurses may enhance their practice and advocate for and are continuing use of this strategy as well as introducing this strategy earlier and in different contexts. We are aware that this is just one mindfulness technique or strategy and others exist. Further exploration of other strategies would be beneficial- particularly in relation to enhancing mindfulness-in-action and not just for the use of mindfulness as a preparatory activity prior to engaging in complex setting and environments.

Limitations of this study include limited generalizability as findings are limited to this cohort. As such replicating the mindfulness activity in other simulations or in clinical contexts may not have the same effect. Despite limitations, this study provides evidence that mindfulness activities can influence workload demands for learners and positively impact simulated clinical learning experiences. More research and collaboration on this in an interdisciplinary level may enhance

the body of knowledge of mindfulness in health-related education. This belief is also aligned with the purposes of the Association for the Study of Medical Education, Special Interest Group – Mindfulness in Medical Education and the Mindfulness Institute. Ultimately, the goal would be to promote the transference of learned skills on how to mitigate workload demands in other situations calling for multiple workload demands.

Conclusion

This Scholarship of Teaching and Learning (SOTL) research study has resulted in a deeper understanding of workload demands that learners experience in simulated activities. When debriefing, it is vital for facilitators to stimulate reflection and promote learning on a variety of workload demands including mental, physical, temporal, performance, effort, and frustration. When using this pedagogical approach, it is also the task of simulation educators to challenge the learner while supporting their development within safe learning spaces. This is especially true when learning situations involve disorientating dilemmas. Mindfulness-based interventions show promise as a means of assisting participants to adapt and focus during stressful situations.

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