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Gamification of Simulation Teaching Delivery

M. Hamza[1,2], K. Kavanagh[1], B. Keane[1], J. Condren[1,2], A. Hennessy[1]

1. Emergency Department, St. James' Hospital, Dublin.
2. National Emergency Medicine Training Programme (NEMTP), Royal College of Surgeons in Ireland, Dublin.

Abstract

Aim

Evidence from recent decades establishing the effectiveness of simulation based medical education (SBME) is widespread. While outcomes relating to knowledge and skills acquisition are demonstrated frequently, some negative affective consequences are identified. Some of these detract from the educational potential of SBME. Use of "gamification" and judicious debriefing are solutions worth exploring. This study aims to produce a gamified learning environment for SBME with guided debriefing, and to assess the affective consequences on learners.

Methods

A literature review was conducted informing the study design. Gamified elements were introduced to weekly on-site simulation competition by using badges for weekly winners and individuals who excelled at aspects of the activity. Structured debriefing occurred after each activity. The validated Satisfaction with Simulation Experience Scale (SSES) evaluated learners' perceptions of the activity in domains relating to debrief and reflection, clinical reasoning, and clinical learning, eliciting important affective responses regarding learner comfort and satisfaction. Paired t-test analysis was used.

Results

Responses showed a statistically significant increase in satisfaction in several domains in the debrief and reflection category, particularly in relation to ease and comfort during the debrief. Responses relating to clinical reasoning and learning also showed significantly increased satisfaction.

Conclusion

Negative consequences of SBME arising from lack of psychological safety can detract from learner engagement. We have shown "gamification" with guided debriefing can improve affective outcomes.

Introduction

There has been a wealth of evidence in the last two decades establishing the effectiveness of simulation based medical education (SBME)[1]; however, while outcomes relating to knowledge and skills acquisition are demonstrated frequently, there is a paucity of data relating to the affective consequences on the learner. From existing literature, significant positive and negative consequences are identified, some of the latter representing significant obstacles to engaging, and therefore detracting from the educational potential of SBME[1–3]. We feel it is necessary to develop practical strategies to traverse these obstacles and make SBME more accessible. Judicious use of "gamification," the use of game design elements in non-game contexts[4], is the possible solution we wish to explore.

This study aimed to produce a gamified learning environment for SBME suitable for use in a single centre, to implement structured debriefing, and to assess the affective consequences of our approach on the participants. We aim to assess affective outcomes as well as those relating to skills and cognition.

The conceptual framework behind the exercise designed was based on self-determination theory.

Methods

The educational activity designed was an on-site simulation competition. Emergency department staff and students were invited to participate. Voluntary participants were then divided into teams, with an effort to distribute these evenly based on profession, grade and at the facilitator's discretion as appropriate.

Weekly simulation challenges, constructively aligned with Royal College of Emergency Medicine (RCEM) and postgraduate emergency nursing curricula as appropriate, were presented to the teams. There was one case chosen per week, which was simulated consecutively by the two participating teams. The challenges were aligned to didactic teaching presented earlier in the morning. Each case was divided into sections, with critical actions required to progress the case.

A facilitator presented the cases and relayed simulated patient responses and information not readily assessable by the participants. The facilitator did not mislead participants and was permitted to volunteer hints at certain times to help progress the simulation. A "foil" was also be employed at times. This was another member of the research team tasked with introducing a challenge to the progress of the case e.g., a distressed friend/spouse.

One or more expert attendees were present on each occasion to score each participating team's performance based on pre-determined criteria for each scenario, for technical and non-technical skills. The assessors included six Emergency Medicine consultants, two Emergency clinical nurse managers (CNM-2s), and two Emergency Medicine registrars. They also facilitated the debrief after each case, according to debriefing guidelines adapted from the Promoting Excellence and Reflective Learning in Simulation (PEARLS) and "Debriefing with Good Judgment" frameworks[5,6]. The PEARLS Healthcare Debriefing Tool was provided to and used by each of the assessors.

The game design elements consisted of small prize incentives. Gold star badges were given to the members of the best performing team each week, which they were free to wear on their lanyards/uniforms until the following week. Special commendation badges were also given to individuals who performed exceptionally well in constructively aligned aspects of the simulation e.g., good communication.

In order to ascertain and evaluate the participants' experiences with simulation prior to participating in this activity, a preliminary survey was distributed. This also included demographic data. Following each weekly debrief, participants were required to complete another questionnaire adapted from the Satisfaction with Simulation Experience Scale (SSES) (Table 1.), a tool consisting of eighteen items organized in three subscales, which was developed through psychometric testing to assess learner satisfaction, which has been correlated with engagement and performance[7]. It has since been validated in nursing and paramedicine to assess learner satisfaction with medium to high fidelity simulation[8]. Using these tools, we evaluated Kirkpatrick level 1 outcomes with Likert scale responses.

Table 1: Satisfaction with Simulation Experience Scale
Debrief and reflection
The facilitator provided constructive criticism during the debriefing
The facilitator summarised important issues during the debriefing
I had the opportunity to reflect on and discuss my performance during the debriefing*
The debriefing provided an opportunity to ask questions*
The facilitator provided feedback that helped me to develop my clinical reasoning skills
Reflecting on and discussing the simulation enhanced my learning*
The facilitator's questions helped me to learn
I received feedback during the debriefing that helped me to learn
The facilitator made me feel comfortable and at ease during the debriefing*
Clinical reasoning
The simulation developed my clinical reasoning skills
The simulation developed my clinical decision-making ability
The simulation enabled me to demonstrate my clinical reasoning skills
The simulation helped me to recognise patient deterioration early
This was a valuable learning experience
Clinical learning
The simulation caused me to reflect on my clinical ability
The simulation tested my clinical ability
The simulation helped me to apply what I learned from the case study
The simulation helped me to recognise my clinical strengths and weaknesses

*Denotes affective domains

Statistical analysis was performed using IBM SPSS. Descriptive statistics were used to analyse demographic data. We also used paired t-test analysis to analyse data from the pre- and post-simulation surveys.

Results

A total of 56 emergency department staff members and students participated in the study. 66.1% were doctors, 21.4% were medical students, 10.7% were nurses, and the remaining 1.8% (n=1) was a health care assistant.

Of the doctors who participated (n=37), 43.2% were internal medicine trainees, 27% were general practice trainees, 21.6% were interns and 8.1% were emergency medicine trainees.

Most of the participants were female (73.2%) and the median age was 27 (range: 22-39).

Analysis of the SSES data showed increases in satisfaction across all 18 domains, most notably in the debrief and reflection section (Table 2.), where all the increases achieved statistical significance. Ease and comfort during the debrief was the domain wherein the greatest increase in satisfaction was observed.

Table 2: Debrief and reflection	**Mean Post-Pre difference**	**p-value**
The facilitator provided constructive criticism during the debriefing	0.268	0.012
The facilitator summarised important issues during the debriefing	0.393	0.001
I had the opportunity to reflect on and discuss my performance during the debriefing	0.571	0.000
The debriefing provided an opportunity to ask questions	0.589	0.000
The facilitator provided feedback that helped develop my clinical reasoning skills	0.518	0.000
Reflecting on and discussing the simulation enhanced my learning	0.214	0.038
The facilitator's questions helped me to learn	0.375	0.001
I received feedback during the debriefing that helped me to learn	0.411	0.001
The facilitator made me feel comfortable and at ease during the debriefing	0.661	0.000

Significant increases in satisfaction were also observed in the clinical reasoning section (Table 3.) and the clinical learning section (Table 4.) in all but one domain in each section.

Table 3: Clinical Reasoning	Mean Post-Pre difference	p-value
The simulation developed my clinical reasoning skills	0.250	0.025
The simulation developed my clinical decision-making ability	0.339	0.003
The simulation enabled me to demonstrate my clinical reasoning skills	0.286	0.028
The simulation helped me to recognise patient deterioration early	0.196	0.094
This was a valuable learning experience	0.304	0.007

Table 4: Clinical Learning	Mean Post-Pre difference	p-value
The simulation caused me to reflect on my clinical ability	0.339	0.000
The simulation tested my clinical ability	0.268	0.012
The simulation helped me to apply what I learned from the case study	0.107	0.322
The simulation helped me to recognise my clinical strengths and weaknesses	0.214	0.027

Discussion

While there is abundant evidence of the effectiveness of SBME, the affective consequences on the learners are not as thoroughly explored. There have been numerous reports of SBME participants citing the experience as being stressful or anxiety inducing, and this has been shown to be a deterrent to participation in further activities[2,3]. In this study, we have produced a gamified learning environment for SBME which has demonstrably positive affective consequences for learners. While the game design elements are likely responsible for some of this, we feel the structured debrief which engendered a sense of psychological safety also played an important role.

Participants in a gamified simulation competition should be there of their own volition, autonomy being a core psychological need in self-determination theory. Beyond the idea of a compulsory game being inherently contradictory, a participant's choice to partake of the activity increases the sense of autonomy and increases engagement[9].

Participants choosing to be there may span almost the entire spectrum of motivational states (barring amotivation): extrinsically motivated individuals will participate solely for the reward or fear of punishment with no appreciated value for the learning potential; those with introjected regulation will have begun to internalize the value, but will still be driven by extrinsic factors such as peer approval or competition with a rival; identified regulation refers to when a learner has fully internalized the initial external regulation, and participates with a hope that doing so will improve prospects for future gain; and finally, intrinsically motivated individuals will participate as participation will give them joy and fulfilment.

The above motivational states are introduced in order of increasing value to the learner, as intrinsically motivated learners will learn more efficiently and effectively. These individuals need no extra incentives, however judicious use of external incentives may improve engagement in those with lower motivational states and may help them internalize their external regulation more readily[10]. This can be achieved through gamification by aiming to address the three psychological needs of self-determination theory, these being autonomy (as discussed above), competence and relatedness[11].

Competence relates to a learner's sense of their own ability to achieve specific goals, as attaining these goals will lead to a sense of competence. This can be incorporated into a gamified approach through clear goal setting and by making attained goals visible. Goals should be presented in increasing difficulty, as proximal sub-goals are shown to provide positive reinforcement and improve motivation[12], and more difficult goals improve performance by increasing expectations. Visibility of the attained proximal goals should also help to alleviate the possible demoralising effect of not achieving the distal goal.

The third psychological need is relatedness, which refers to how connected the learner feels to their peers. Central to this is the need for the learning environment to be supportive and psychologically safe, encouraging inquiry and engendering a sense of interconnectedness[13]. This facilitates internalizing motivation, particularly in a team environment where collaborative learning communities boost motivation further[14].

Challenges to successful implementation exist in the gamification literature. Chief among these is the "over justification" effect, wherein the over-reliance on external regulation in the design of an activity results in a net reduction of the learner's internal motivation. This overreliance reduces the learner's sense of autonomy and thereby externalizes their motivation further. This can be overcome by supporting the learner's psychological needs as discussed above, and by aligning the game design to their psychological needs[10].

Our focus on improving learner satisfaction is supported by evidence that increased satisfaction not only improves motivation for learning, but also increases the learners' self-confidence and sense of efficacy[15]. The SSES we used to evaluate learner satisfaction in this study is a scale which was developed by Levett-Jones et al.[7], and has been validated in nursing and paramedicine[8], however it is not profession specific, and we feel it is the best tool currently to assess Kirkpatrick level 1 outcomes, particularly in our multi-disciplinary sample.

We believe that the globally positive results reflect the theoretical underpinnings of the educational design of the activity, but also the evidence-based approach to the debrief process. This is evident in the more pronounced increases in satisfaction in domains relating to debrief and reflection. As with Okuda et al.[16], we found that a carefully delivered debrief, even publicly and in the context of a competitive simulation did not detract from the psychological safety of the participants. This was coupled with the engagement gains the gamification and competition format provided, as these have been shown to improve engagement significantly[17,18], to provide a positive and engaging learning environment.

The benefits also do not end with the active participants in the simulation. The remainder of the attendees, while not partaking of the experiential phase of the learning cycle directly, benefit from observational learning as well as social learning[19,20].

There are several limitations to this study. We evaluated Kirkpatrick level 1 outcomes, which may increase learner participation and engagement, however we cannot infer any knowledge or skills acquisition on the participants' part based on this. Similarly, while the responses show that learners felt that there were benefits to clinical learning and reasoning (e.g., "The simulation developed my clinical decision-making ability") we cannot infer that this would translate to clinical practice.

Secondly, we must acknowledge the likelihood of a selection bias, in that those individuals who are more likely to enjoy SBME and/or competitions are more likely to volunteer for and subsequently report improved satisfaction in this type of activity.

Thirdly, none of the assessors had received formal training in post-simulation debriefing. However, a PEARLS Healthcare Debriefing Tool was provided to and used by each of the assessors.

In this study, we have designed and implemented a gamified learning environment for SBME, with a strong theoretical framework, and shown that, when used in concert with structured debrief, has positive affective consequences for the learners. Further research is required to determine if this has implications for knowledge and skills acquisition.

Declaration Conflicts of Interest:
The authors have no conflicts of interest to declare.

Corresponding Author:
M. Hamza,
Emergency Department,
St. James' Hospital,
Dublin.
E-Mail: mohammed.hamza@outlook.ie

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