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The pit crew card game: a novel gamification exercise to improve EMS performance in critical care scenarios

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Abstract

Background Gamification can be defined as the use of game design elements in non-game contexts, in this case, education. As such, gamification seeks to augment the interactive approach of adult learning theory which promotes ongoing motivation and engagement. The objective of this study was to develop and implement a gamified learning module to teach the pit crew approach to Emergency Medical Services personnel in an interactive, engaging format. We created a game-based simulation scenario, an introductory video, and a post-session survey to assess the effectiveness of our educational innovation. We hypothesized that gamification would strengthen classroom engagement and attitudes toward clinical education as assessed in the post-session survey.

Methods This was a pilot study to assess the characteristics of a novel, gamified educational session. We created teams of 5 personnel with various experience and levels of training. Our educational session began with an introductory video and the Pit Crew Card Game, a novel, interactive card game where the facilitator leads teams through a verbal scenario and administers task cards to the team leader based on interventions and other tasks the group verbalizes. After the game, teams were engaged in an interactive critical care simulation scenario where they were expected to perform tasks based on their pre-assigned roles. After the exercise, we administered a brief survey to assess learners' perceptions about the effectiveness of this novel educational session as well as whether participating in this activity would change their behaviors in future real-life critical care scenarios.

Results 96 participants completed the post-session survey. The Pit Crew Card Game was heavily favored over traditional lecture-based learning sessions, with 84% of respondents indicating agreement. 77% agreed that the game improved their understanding of how to utilize the pit crew approach for critical care scenarios and that it was an effective teaching, teamwork, and communication tool.

Conclusion Based on these results, we conclude that gamification has potential as a preferential and feasible learning method for critical scenario training among prehospital personnel. Participants reported that the Pit Crew Card Game increased their understanding of pit crew concepts, promoted effective communication and teamwork,

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and was an overall effective teaching tool. We recommend further expansion of gamified teaching strategies to the prehospital education realm and support for future research in this domain.

Keywords Gamification, Emergency medical services, Pit crew approach, Medical education

Background

Medical education has for many years required long and arduous classroom-based teaching strategies using textbooks, unilateral didactics, and rote memorization for classical testing strategies [1, 2]. For the last decade, there has been a shift towards alternative teaching strategies such as small group learning, simulation, and gamification [3–11]. Gamification refers to using game design elements in an effective way to augment the traditional medical education approach [10–12]. Gamification allows for competency-based education in a way that limits learner burnout while creating a sense of fun that promotes ongoing participation and engagement [11, 12]. Few specialties appeal to these strategies better than the training of prehospital/emergency medical services (EMS) staff such as Emergency Medical Technicians (EMTs), Paramedics, and Firefighters. Due to the nature of these specialties, first responder education requires non-traditional teaching methods due to the need for a short-duration curriculum, a team-based focus, and the development of adaptable crews due to adverse environments [6]. Interactive educational strategies such as gamification have allowed for more effective teaching in a shorter amount of time [13–15].

Our objective was to develop a gamified learning module to deliver concepts relating to the pit crew approach in an interactive and engaging format [16, 17]. We developed an introductory video, a game-based simulation scenario, and a survey to assess the effectiveness of our gamified approach to first-responder clinical education. Aspects of interest included team members' ability to understand their role in clinical scenarios, ability to distinguish team leaders in critical scenarios, how likely team members are to miss key tasks, personal preference for game-based learning versus lecture, and likelihood to integrate into future practice. We hypothesized that gamification, similar to simulation, would improve the learning outcomes of EMS personnel by increasing engagement and favorable attitudes toward clinical education.

This project was previously presented as an abstract at the 2022 Society for Academic Emergency Medicine Scientific Assembly in New Orleans, LA [18].

Methods

Study Design and setting

The study was conducted with members of the Osceola County Fire Department, a fire-based EMS system with 233 paramedics and 115 EMTs, and Kissimmee Fire Department, a fire-based EMS system with 69 paramedics and 37 EMTs. The system collectively responds to 41,000 calls per year. This pilot study was designed to be exploratory in nature, gaining insights regarding the potential impact of gamification as an educational strategy among various EMS responders.

Population

Personnel from each of the stations were asked to create teams of 5 with varying levels of experience/training including EMTs and at least 2 paramedics (paramedics and paramedic firefighters) per team.

Intervention

A total of 20 crews rotated through this 1-hour training as required by their agency in October through November 2021 during regular duty hours. The educational session started with an introductory video followed by the Pit Crew Card Game to teach basic concepts related to the pit crew approach. This was followed by a critical care simulation scenario where each team had to perform tasks based on pre-assigned roles. A post-session survey was administered to assess learners' perceptions about the effectiveness of this novel educational session as well as whether participating in this activity would change their behaviors in future real-life critical care scenarios. Questions were scored on a 5-point Likert scale (1 = Strongly Disagree, 3 = Neutral, 5 = Strongly Agree). The study protocol was approved by the local research committee and deemed exempt by the hospital's Institutional Review Board.

The pit crew card game

The Pit Crew Card Game was designed by the researchers as an innovative way to deliver knowledge and reinforce concepts of the pit crew approach. In playing the Pit Crew Card Game, a facilitator leads each team through a verbal scenario. As team members verbalize certain interventions and other tasks, the facilitator distributes task cards to the team leader. Points are awarded based on the amount of cards received.

There are a total of 28 task cards, each highlighting a specific task that must be completed during the scenario. The scenario involved a young male patient who becomes hypoglycemic and crashes into a telephone pole. The patient is a burn victim due to the nature of the accident and deteriorates en route to become a traumatic cardiac arrest patient. As the scenario progresses, the facilitator gives a card to the team leader for each task verbalized by

Table 1 Participant survey questions

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree	
1.	I found the hands-on simulation scenario easier having been delegated a task in the card game or delegating a task (if team leader) prior to going through the actual simulation.
2.	Utilizing the pit crew approach for critical scenarios makes it easier to understand your role.
3.	Utilizing the pit crew approach decreases the chances of missing important key tasks.
4.	I prefer the Pit Crew Card Game rather than a lecture on the pit crew approach.
5.	The Pit Crew Card Game helped me to better understand how to utilize the pit crew approach for critical scenarios.
6.	The Pit Crew Card Game was an effective teaching tool.
7.	The Pit Crew Card Game was an effective teamwork and communication teaching tool.
8.	I will change my future practice because of this activity.

the group. The team leader has the responsibility to delegate that task card to the appropriate personnel, based on scope of practice and availability. Some cards will require that the delegated personnel verbalize information to the team leader. For example, the "obtain IV" card reads: "difficult IV access x 2, IO successful in the left humerus". The full list of task cards can be found in the appendix.

The Pit Crew Card Game concludes with a debrief on the team leader's delegation followed by an "ideal" delegation established by the researchers. This ideal delegation is based upon EMT vs. paramedic scope and categorization of tasks based on the commonly referenced "ABC's": airway, breathing, circulation, disability, and exposure.

Follow up Simulation

After the team members are given task cards with the ideal delegation, they are asked to perform these tasks in the follow-up simulation scenario, as needed. This simulation involves an older male with a history of diabetes and hypertension, who is the restrained driver in a vehicular accident caused by a stroke. In this simulation, the patient deteriorates en route, necessitating the team to also manage a traumatic cardiac arrest. The goal of the simulation is to allow for the practice of pit crew concepts in role delegation by having the team members perform tasks based on the task cards they were pre-assigned.

Data Analysis

Data analysis was performed using Microsoft Excel, with descriptive statistics employed to summarize the results. The primary outcome measured was the favorability of the Pit Crew game approach compared to traditional learning. Secondary outcomes included ease of understanding the Pit Crew method for critical scenarios and assessing whether this approach effectively teaches teamwork and communication skills.

Results

After the activity, participants completed a survey indicating their level of agreement with the following statements using a 5-point Likert scale. See Table 1 below. 96 of 78% of participants reported that they agreed or strongly agreed that being delegated a task in the card game made the simulation scenario easier. Similarly, participants overwhelmingly found it easier to understand their role in critical scenarios with 88% reporting agreement with the statement "Utilizing the pit crew approach for critical scenarios makes it easier to understand your role." 81% of respondents agreed or strongly agreed that using the pit crew approach decreased the chances of missing important key tasks. The Pit Crew Card Game was highly favored by learners, with 84% of participants indicating a preference for the game rather than a traditional lecture to learn the material presented. For statements 5, 6, and 7, the favorable responses continued with 77%, 86%, and 83% respectively indicating that the game was effective in helping them understand how to utilize the pit crew approach for critical scenarios and that it was an effective tool for teaching, teamwork, and communication. Based on the 96 surveys received, the Pit Crew Card Game appears to be an effective educational strategy and was well-received by this group of learners. The activity proved to be an innovative, engaging, and effective model for learning.

Discussion

With increasingly busy prehospital providers and their unique need for non-traditional learning modalities, the search for more effective teaching methods continues. This study explored using a gamified learning module to help prehospital providers acquire knowledge regarding the pit crew approach in critically ill patients. Many studies have assessed the efficacy of gamification as a learning tool, noting increases in participation and engagement [4, 7, 9, 10]. However, reports of gamification in prehospital education are limited [5, 6]. Also, much of the literature on gamification in medical education revolves around digital technology [13–15].

In contrast, this study employed a team-based, in-person card game. This was designed to break down the delegation of tasks involved in the pit crew approach and

implement cognitive offloading of the lead medic onto other members of the crew. A technology-free gamification module was used to promote teamwork and communication among the participants. The majority of prehospital providers participating in this study reported that a novel, gamified learning module increased their understanding of the pit crew approach, helped to promote effective communication and teamwork, and was an overall effective educational strategy. This study supports the extension of gamification as an educational strategy in the prehospital setting, as a means to promote participation and engagement. While the focus of this study was to gain insight into the perceptions of prehospital learners on the implementation of gamification in their education, future studies should assess higher levels of evaluation in Kirkpatrick's model, focusing on learning, behaviors, and ultimately, patient outcomes [19].

Limitations

As a pilot study, the results are exploratory and should be interpreted with caution. There are several limitations to address, including the absence of a control group, survey methodology, inability to stratify results based on learner type, and data including only learner perceptions rather than knowledge translation, change in behavior, or patient outcomes. Given the design of the study and voluntary completion of the survey, there is a risk of self-selection bias and non-response bias. 96 of the 100 participants in the educational session completed the full survey, therefore, there is not sufficient information to determine if the four non-responses would have impacted the results significantly. Additionally, the survey did not collect specific information about participant roles (e.g., paramedic, EMT, or group leader). As a result, subgroup analysis based on participant roles or assessment of differences between leaders and other participants could not be performed. Future studies could benefit from collecting and analyzing this type of data to explore potential role-based differences in perceptions of the Pit Crew approach.

Further, data included only learners' perceptions of the educational innovation rather than exploring higher levels of evaluation in Kirkpatrick's model, such as a knowledge assessment or observation of behavioral change amongst learners. Future research should aim to address these limitations with more robust study designs.

Conclusion

This study sought to translate the successes of educational gamification in other realms to the prehospital setting, teaching the pit crew approach to emergency medical services personnel. Gamification, through the Pit Crew approach, shows potential as a preferential and feasible learning method for critical scenario training.

However, further research with more rigorous, controlled study designs is needed to determine its effectiveness compared to traditional educational approaches, such as lecture-based learning. Future studies should seek to investigate knowledge translation, behavioral change, and patient outcomes as a result of gamified educational strategies for prehospital providers.

Abbreviations
EMS   emergency medical services
EMT   emergency medical technician

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12245-024-00748-5.

Supplementary Material 1

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval
This study was conducted in accordance with the *Declaration of Helsinki* and exempt by the HCA Centralized Algorithms for Research Rules on IRB Exemptions (CARRIE).

Consent to participate
Not applicable.

Consent for publication
not applicable.

Competing interests
Dr. Latha Ganti serves as Editor-in-Chief of the International Journal of Emergency Medicine.

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