SIMULATION IN TEACHING WITHIN THE HEALTH AND ENGINEERING FACULTIES OF SAUDI UNIVERSITIES

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ABSTRACT

This study was carried out to investigate the current status of simulation use during teaching within health sciences and engineering faculties at Saudi universities. Simulation in teaching has been shown to be effective at enhancing student understanding. However, the current status of simulation use in teaching, especially in Saudi universities, remains unclear. To address this, here we aimed to: determine the ability of simulation to achieve appropriate levels of realism; identify the effectiveness of simulation at improving skills, awareness, and knowledge in health sciences and engineering; and test whether simulation improves the critical and evaluative thinking of students. Data were collected using online questionnaires. We found that simulation is being effectively applied in Saudi universities.

KEYWORDS

Simulation; understanding ; skills; realism; critical ;evaluative.

1. INTRODUCTION

Simulation in teaching or learning can be described as an artificial representation of the real world through experiment to attain specific skills (Deng et al. 2015). Simulation enables learners to acquire skills and knowledge by working in a relatively simplified system. Simulations mostly used to improve skills in health care. In teaching, simulation is used to improve critical as well as evaluative thinking. This is because most teaching simulations are open-ended or ambiguous, encouraging the student to contemplate the scenario. As discussed by Lin and Cheng (2015), simulation helps learners understand contents through experiments. Through simulation, students are more engaged compared to the cortical learning without experimentation. As discussed by Action et al. (2015), simulation helps students to appreciate the management of politics, culture, and the environment. For instance, a student participating in the act of distribution might gain a better understanding of equality in society. Therefore, the skills of that student can be reinforced indirectly through research skills or debating. However, the experiences of the simulation might be more realistic than the experiences gained through other techniques. Thus, simulation allows students to become more engaged, often forgetting the educational aims of the exercise. Some of the simulations usually have elements of competition, and in such cases, it is important to remind the student that the important thing is not winning but acquiring understanding and knowledge. This study aimed to determine the current status of simulation in teaching within health sciences and engineering faculties at Saudi Universities.

2. BACKGROUND

Simulation has been used in various Saudi universities and for multiple purposes, but mostly applying similar principles (Action et al. 2015).

In Saudi Arabia, the number of students taking courses within health sciences and engineering faculties has been increasing at an exponential rate. According to Beal et al. (2017), the health sector has been increasing over time. To enhance the quality of training, Saudi universities have been emphasizing the use of simulation in science and engineering. As a result, these students are offered better education services; achieve better understanding, and acquiring more knowledge. Therefore, the students get the required competency at the end of their training.

3. PROBLEM STATEMENT

Simulation in teaching is important because it enhances student understanding. Simulations achieve this mainly by helping students to better contemplate various problems that might occur in their area of study. As students carry out various experiments, they become familiar with concepts and acquire the required skills and knowledge. In Saudi Arabia, the number of hospitals has been increasing rapidly. Since 1986, the number of health institutions in Saudi Arabia has increased from three to more than 100 (Kassem et al. 2017).Both health sciences and engineering can work together to produce health professionals.

Additionally, various researchers have been carrying out studies related to simulation in teaching. For instance, Nousianen et al. (2016) investigated the availability of simulation used in teaching orthopedic residents in a curriculum that is competency-based, and Lin and Cheng investigated on the role that simulation plays in teaching pediatric resuscitation. Udani et al. (2015) have investigated the use of simulation in teaching regional anesthesia, and Beal et al. (2017) investigated point-of-care teaching versus simulation-based teaching for identification of basic transoesophageal echocardiography views. However, to our knowledge, no study has attempted to investigate the current status of simulation use in teaching within health sciences and engineering faculties in Saudi Universities. Here we aim to address this gap in the literature.

4. OBJECTIVES

The principal objective of this study was to determine the current status of simulation use in health sciences and engineering faculties in Saudi Universities. The specific objectives were;
To determine the ability of simulation to offer appropriate levels of realism;

To identify the effectiveness of simulation in improving skills, raising awareness, and providing information in the health sciences and engineering; and

To investigate whether simulation improves critical and evaluative thinking.

5. IMPORTANCE OF THE STUDY

This study will provide a better understanding of the use of simulation in health sciences and engineering. This will likely lead to greater use of simulation, thereby improving the evaluative and critical thinking of the students.

6. LITERATURE REVIEW

Theoretical Literature

According to Ogilvie et al. (2016), simulations are scenarios illustrated in a learning process, whereby the learner is placed in a real-life situation. Simulations represent a reality, whereby the students are allowed to interact. Therefore, students experience reality in the scenario and gather

information in terms of meaning from that scenario (Bean et al., 2017). In the study of Lin and Cheng (2015), simulation is a means of experiential learning.

Simulation can, through a student-centered approach, enhance constructivist teaching and learning. The simulationmight contain a game, a role, or even an activity. In most cases, simulations are non-linear and include ambiguity, in which students are expected to make decisions. Therefore, the success of a simulation is determined by the commitment and inventiveness of the participants.

Simulations in Engineering

The use of simulations has increased in many engineering practices (Udani et al. 2015). This is because simulations provide unprecedented access to the real world. Also, simulations are freed from certain limitations (e.g., unrealistic parameters, cost constraints, and health and safety concerns).According to Mc Cabe et al. (2016); simulation in engineering has become fundamental in the generation of predicting models in climate change, weather, and atmospheric behaviors. In return, it has enhanced a broad analysis and design in the area, thus improving the competence of engineers. Various organizations that require engineers during production have also incorporated simulations into their processes. The appropriate use of computers or other machines can enhance the production of goods and delivery of services. Furthermore, simulation in engineering is applied in various contexts, including communication, transportation, and defense. Lin and Cheng (2015) argue that simulation has long been applied (for decades) in engineering.

Deng et al. (2015) have reported a relative underuse of simulation in Saudi Arabia relative to Europe and Japan. Nevertheless, Kassem et al. (2017) have noted that the proportion of students studying science and engineering in Saudi Arabia is increasing.

Health Sciences

Simulation is being increasingly applied in health sciences. According to Ogivile et al. (2016), most diseases and their treatment require physical responses and involve complex interactions. During the teaching of health sciences, simulations are mainly used to increase the students' understanding of diseases and their treatment (Action et al. 2015). The importance of computerscience in the teaching of health sciences has increased. A major challenge in the application of simulation to health sciences is being able to represent biological systems at the organ, tissues, and cellular scales. Therefore, simulation in medical practices requires an understanding of complex systems. Thus, the teaching of both engineering and health sciences requires sophisticated technologies and computer analyses.

Historically, medicine has combined both empiricism and diagnosis (Boto et al. 2016). Simulation in health sciences improves medical practices by helping to predict treatment outcomes. Statistical analyses are also carried out to ensure treatment efficacy (Willems et al., 2017).

Empirical Literature/Case Studies

In 2016, Nousiainen et al. carried out a study in teaching orthopedic residents in a competency-based curriculum. This study aimed at enabling surgeons to gain a better understanding of bone and muscle deformities. The study also investigated cost reduction during the treatment of these diseases. From the study, effective medical services are achieved by having qualified and experienced doctors. This can also help to improve the time in which the services are offered, serving many patients within a short period (Jeffries et al. 2015). Greasley (2017) also tested

whether simulation could improve the effectiveness of various activities in multipledisciplines. The study majored at improving the critical and evaluative thinking, improving skills, awareness and health information and measuring appropriate realism. The study applied a primary source in data collection, and after the analysis, it displayed a positive relationship between the variables and the model. This significantly showed that these were the main agendas of simulation.

Research Gaps

Nousiainen et al. (2016) investigated the competence of orthopedic residents and aimed to provide the students with the required skills and knowledge. Greasley (2017) investigated the effectiveness of a teaching simulation and detected a positive relationship between the variables and the model.

7. METHODOLOGY

Research Design

A research design is a set of procedures and methods used in data collection and analysis (Saha et al.2015).Greasley(2017) have argued that research design is important because it allows data collection at one point to represent many areas. Our study adopted a qualitative data collection approach using an online questionnaire. The questionnaire included both open and multiple choices questions.

Study Area

This study was conducted to investigate the current status of using simulation in teaching in health sciences and engineering in Saudi Universities. The participating universities were Al-Imam Mohammad Ibn Saud Islamic University, ImamAbdulrahman Bin Faisal University, King Abdul-Aziz University, and King Saudi University (KSU). Various respondents were given online questionnaires related to the current use of simulation in both health sciences and engineering departments. This study aimed todetermine the ability of simulation to achieve appropriate levels of realism, to improve students' skills, awareness, and knowledge, and to enhance critical and evaluative thinking.

Sampling Procedures

Both random and stratified samplings were used. A stratified technique was used to approach the heads of departments, while a random sampling technique was used to choose student respondents. According to Sekhar et al. (2017), a sampling procedure is a process in which a subgroup is chosen from a population.After selecting respondents; online questionnaires were posted to them, which they were required to answer within a specific period.

Target Population

The target population (Evanno et al. 2005) of this study included the staff, managers, and students at the health sciences and engineering departments of Saudi universities. In total, 80 respondents (20 each from four universities) took part in the study.

Data Collection Instrument

The study questionnaires were distributed to the respondents through random and stratified sampling and were expected to be answered at the same time. Before sending the questionnaires

to the respondents, a brief description was given to explain the aims of the study and how their data would be used.

Data Analysis and Presentation

After gathering the data, the responses were checked for completeness, dependability, and accuracy. Below, these data are presented as simple charts and tables.

8. FINDINGS

All 80 respondents (from four universities) reported that their schools were using simulation in teaching.

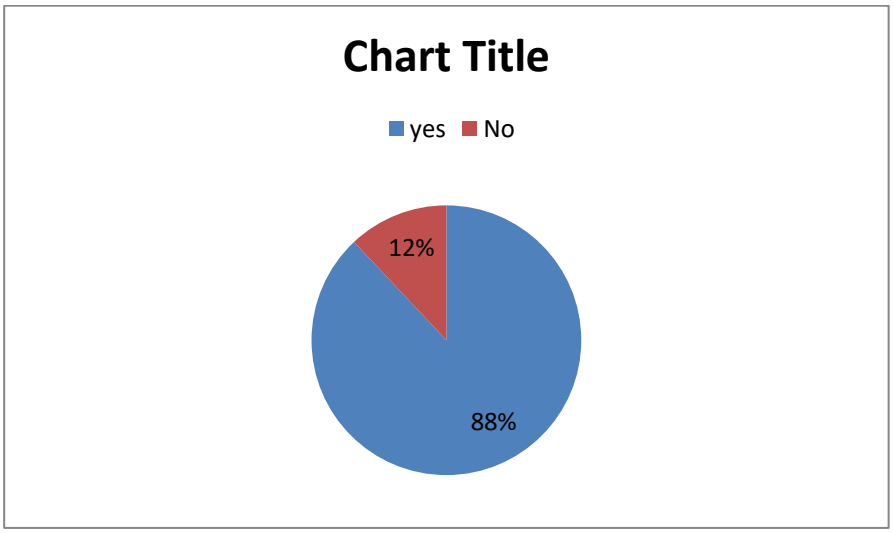

Figure 1.Theeffectiveness of teaching simulations.

We asked respondents whether the teaching simulations were effective. Among the80 respondents, 88% agreed (responded 'yes'), and12% disagreed (responded 'no').

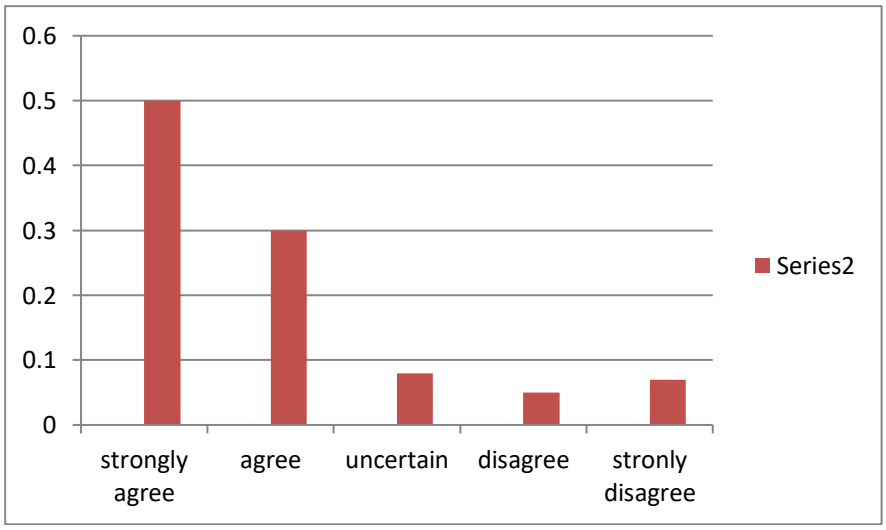

Figure 2.Does simulation achieve an appropriate level of realism?

In response to the statement 'simulations achieve an appropriate level of realism', 50% of the participants strongly agreed, 30% agreed, 8% were uncertain, 5% disagreed, and 7% strongly disagreed (Fig. 2).

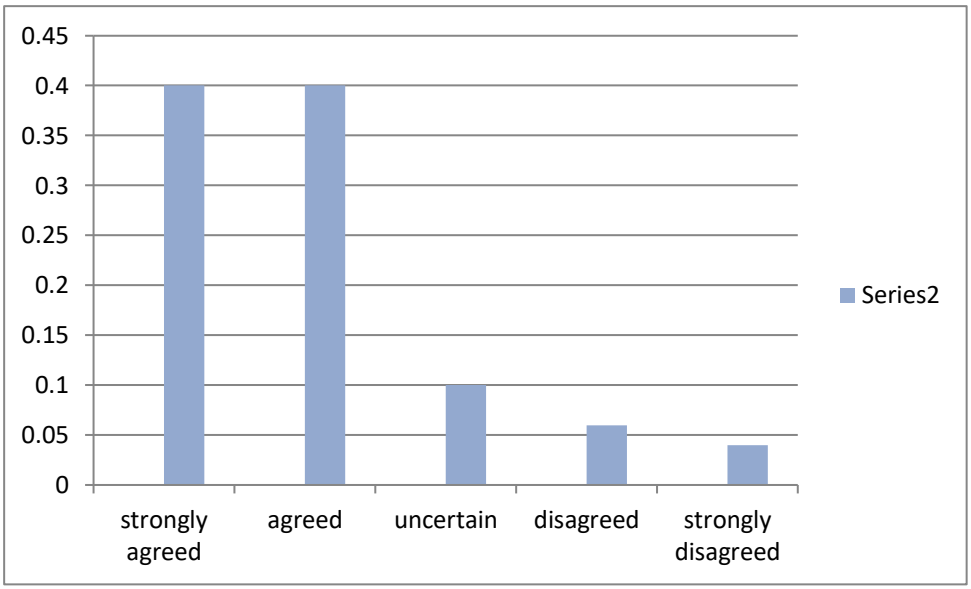

Figure 3.Simulation in improving skills, raising awareness, and providing information.

Figure 3 reports the responses of the students regarding the statement 'Simulation improves skills, raises awareness, and provides information'. Eighty percent of the respondents were those who agreed with the statement (40% agreed, 40% strongly agreed). Ten percent of the respondents were uncertain, 6% disagreed, and 4% strongly disagreed.

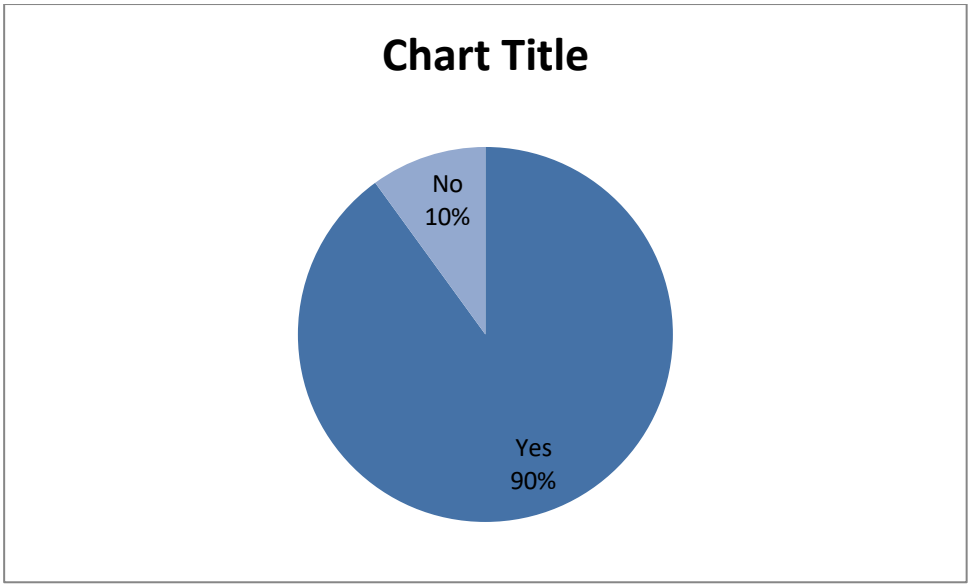

Figure 4.Simulation in increasing critical and evaluative thinking.

Figure 4 shows the respondents' responses about simulation and critical and evaluative thinking. Ninety percent of the students reported that simulation in teaching had improved their critical and evaluative thinking.

9. DISCUSSION

Most of our respondents agreed that simulations have been helpful during their studies. This implied most of the universities in the country were using and are still using simulation as their mean of enhancing better understanding for their students. Second, most respondents agreed that the simulations that they had used provided an adequate level of realism. This finding suggests that the technologies used for simulations have become sufficiently advanced. Our respondents also agreed that simulation could improve skills, raise awareness, and provide information in health sciences and engineering. Lastly, our respondents agreed that simulation was effective at improving critical and evaluative thinking.

10. CONCLUSION

Based on our data, simulation appears to be widely used (all universities included in our study) in the teaching of health science and engineering in Saudi Arabia. Also, our findings suggest that this technology is being appropriately applied and is improving teaching standards. Based on these findings, we predict that simulation technologies will help to meet the increasing demand for competent doctors and engineers in Saudi Arabia.

11. RECOMMENDATIONS

From the above study, the following recommendations can be made;
Health sciences and engineering faculties in Saudi Universities need to incorporate discoveries in their studies to enhance multidisciplinary as well as multiscale simulations.
Supporting technologies in both fields need to be enhanced to improve the understanding of students during simulation, thus increasing their skills and competency
Education institutions currently not using simulation during teaching should introduce these.

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