Use of Robotic Simulation in the training of Nursing Students of the Faculty of Health Sciences: Perceptions

A Romero¹, D Valderrama¹ and J D González¹
¹ Universidad del Magdalena, Santa Marta, Colombia
E-mail: jgonzaleza@unimagdalena.edu.co

Abstract. Clinical simulation is rapidly becoming an important tool in the training of students who pursue a career in nursing as a viable complement or a substitute for practice with living patients. Although simulation can never replace real clinical practice, it is a useful tool to create realism before performing practical skills during patient care. Robotic simulation can create real scenarios that not only test knowledge, but also provide a safe environment for practicing advanced concepts and difficult patient situations. Members of the nursing faculty often have the challenge of preparing nurses for complex environments and working with interdisciplinary teams. In addition, health care administrators expect a basic competency from new nursing graduates who are prepared to function in the complex work environment independently after orientation. An exploratory and descriptive study was conducted using surveys among the students of the nursing program on the use of a humanoid robot for teaching nursing in the laboratory of practices of the Magdalena University. The results of this study indicate that, in the program and students are positively motivated about the use of technology as a teaching strategy (especially humanoid robots), which suggests a greater exploration of its use in education Nursing.

1. Introduction
Nursing has undergone profound changes in recent decades. Increasingly, nursing professionals are expected to understand and conduct research, and to base their practice on research evidence, that is, to adopt an evidence-based practice. A broad definition of evidence-based practice is the use of the greatest evidence to make decisions about patient care. This evidence almost always comes from research conducted by professionals in nursing and other health areas. According to Burns et al. the ultimate goal of Nursing is an evidence-based practice that promotes quality and cost-effective results for patients, their families, healthcare professionals and the healthcare system [1, 2]. This is developed from the integration of the best evidence in the clinical experience and the needs of the patients, in that order of ideas, the clinical experience is conceived as the knowledge and skills of the healthcare professional to offer care; With evidence-based practice, patients and their families are encouraged to take an active role in managing their health. In the teaching of Nursing, new didactic strategies for the acquisition of competencies as a caregiver have been included, so that the use of clinical simulators that allow the development of an effective and safe level of experience is undertaken. The simulated scenarios manage to develop in the student skills and abilities prior to designing a scenario in which the skills to be developed
and the learning outcomes are taken into account. Robotic technology refers mainly to robots or simulators, which are physically incorporated systems capable of executing change in the world. The robots enact this change with effectors that move the robot itself (locomotion), or move objects in the environment (manipulation), and often use sensor data to make decisions. Simulators can have varying degrees of autonomy, ranging from teleoperated (the operator makes all the decisions for the robot) to Autonomous (the robot is totally independent). The term robotic technology also includes broadly affiliated technology, such as the accompanying sensor. Systems, data processing algorithms, etc. [3, 4, 5]. As a discipline, robotics has traditionally been defined as the science that studies the intelligent connections between perception and actions, although in recent years this has shifted outward, focusing on related problems to interact with real people in the real world (Siciliano and Khatib, 2008) This change has been referred to in the literature as man-centered robotics, and an emerging area in the last decade focused on problems in this space is known as human-robot interaction (HRI). The use of robotic technology in mental health care is incipient, but it represents a potentially useful tool in the professional’s toolbox. According to Peter Dickman it is a simulation environment all the activities that gather people in time and space around a simulator [6, 7]. In that sense, in the training of doctors, simulation does not ensure the development of competences, it contributes to the development and training of the elements that make up competencies [5]. In simulation or practice of clinical robotics, the levels of fidelity that can vary from low, medium to high fidelity are identified; which can be used in the training of the student depending on the degree of performance that is desired in the field of knowledge. Most simulators can be classified as standardized patients, partial task trainers, dummies (high fidelity patient simulators), screen-based computer simulators, and virtual reality simulators [8]. Standardized patients are trained actors to simulate various symptoms, give medical histories, and show various emotions during a medical examination. Partial task coaches are a type of simulator used to teach specialized skills, such as intravenous placement, centerline, endotracheal. Placement of tubes, or other high risk/low prevalence procedures. Although the standard criteria for distinguishing between high and low fidelity simulators have not been firmly established, coaches are classified as low to high fidelity, according to how they closely mimic the circumstances in which the skill is found [9, 10]. In the process of teaching and training of human talent in Nursing, it is necessary to understand the perceptions from the subject of learning, about the use of simulators in the development of skills, taking into account that simulation scenarios should be considered as an opportunity in meaningful learning prior to real experiences. In that sense, we seek to analyze the perception in the use of simulation, discuss the use of robotic technology in the formation of human talent in health and explore the potential of emerging technology. The implementation of technological strategies in the development of competencies with a clear objective of learning in the formation of Nurses, has led teachers to acquire skills and abilities in the management of virtual environments and use of simulators that generate a space conducive to students. Goodrich and Schultz (2007) describe the problem of HRI as seeking to understand and shape the interactions between one or more humans and one or more robots. They break down the problem into five main attributes: (i) the level and behavior of the autonomy of a robot, (ii) the nature of the exchange of information between humans and robots, (iii) the structure of the human-robot team, (iv) how people and robots adapt and learn from each other, and (v) how the task shapes the interaction [3].

2. Robotics in the field of education
Simulation in the Teaching of Nursing has been increased over last years which include the use of simulations in the training of professionals of health sciences and nurses at different levels of their education. This technique that has been used in formal nursing education for more than 20 years, this has allowed a better training of nursing students and surgical residences
in the application of invasive and surgical techniques. The simulation in the health area is

![Figure 1: (Color online) Maternal and Child Unit - Simulation Clinic - Universidad del Magdalena. Group of students preparing equipment to perform airway assessment and orotracheal intubation procedure to a simulated 6-year-old patient. Simulator: SimJunior - Laerdal Medical AS - REF: 232 - 05050 - Series 232UMS1715004. 2015 model.](image)

a mutual work agreement between the student, teacher and simulator where the paradigms of the teaching and learning processes are changed, where the use of the simulated patient and the activities of the educator plays an important role as an advisor or facilitator, because it allows continuous communication towards the presentation of real situations (Fig.1). Clinical simulation is beneficial for repeating procedures and gaining confidence in themselves and for patient safety, as well as for decision-making and broadening critical judgment in everyday hospital situations in a minimal risk environment. This is because the characteristics of the robots allow the teacher to create scenarios where various normal and abnormal situations similar to those present in a patient are presented and which may or may not be frequent in the reality of the training practice or in the work performance. In these scenarios the student can demonstrate the number of times the level of competence acquired is necessary when applying the appropriate procedures using the techniques in a correct way, obtaining signs of recovery programmed in the robot or failing those that infer complication of the condition Initially presented to the student. One of many examples may be the possibility of simulating with a robot the birth of a pregnant woman and performing the necessary procedures for proper care, which helps the student to appropriate the necessary skills in a safe environment without putting at risk the life of the mother-son binomial. (Fig.2). The use of robots in nursing education are now able to expand the reach different programs through various distance education technologies. Due to the students and instructor are separated physically, the distance education technology formats include the use of broadcast television, telephone, or interactive video teleconferencing to connect an instructor to students in one or more distance locations. This method improve
Figure 2: (Color online) Maternal and Child Unit - Simulation Clinic - Universidad del Magdalena. Simulator: SimMon- Laerdal Medical AS - REF: 378 - 00001- Series 377M47130005. 2013 model. This simulator allows to simulate situations and perform procedures such as: Delivery in different presentations (cephalic, podic), application of forceps, shoulder dystocia, eclampsia cord prolapse, preclampsia, postpartum hemorrhage, uterine atony, placental retention, uterine inversion, uterine rupture, vaginal touch, among others.

the education opportunities as well as courses that include supplement learning through an online, virtual presence in what is referred to as hybrid formats leading to academic degrees and certifications.

Figure 3: (Color online) Analysis of statistics from the six Likert-type questions from student surveys about the usefulness and effectiveness in the training of nursing. For each of these Likert items, a 1 indicated a low value and a 5 indicated a high value.
2.1. About the Study

Descriptive statistics were used to analyze the answers to 10 Likert-type questions from student surveys on utility, effectiveness and user friendliness and satisfaction with the presence of a humanoid robot in a simulated clinical experience. For each of these elements of the Likert’s survey, ranging from 1 (strongly disagree) to 5 (strongly agree). In terms of student perceptions, and to establish the reliability of the instrument, Cronbach’s alpha was calculated with a value of 0.91, reflecting a high reliability of the instrument applied to the group of students in the nursing program. The overall mean score show that students initial impression was somewhat favorable. However, later, students seemed to change their impression positively regarding the technology and its use in nursing education. It can be notice in the graph of question 1, it is robotics an effective teaching tool? it is robotic simulation an effective teaching tool?, shows us that there is a very positive acceptance of robotics as a teaching tool, that is, 76%, while 24% considers it normal. But also, in the question 2, what was your reaction on the humanoid robot/simulator? 53% positive, 18% very positive, 26% normal, 3% negative, it should be noted that this question also favorability in contact with the robot was positive and only 3% considered it negative (see 3).

In terms of effectiveness of the robot, the questions 3, 4, 5 and 6 are truly related Fig. 3. 3. Do you think that a humanoid robot/simulator could be useful as a teaching tool in the care of patients in the clinic and hospitals of the city? 56% consider it positive, 21% very positive, 18% normal, 5% negative, most interview students consider this very important devices since it helps them improve their clinical practice and enables them to positively develop their professional performance. 4. Do you think that training students with human robotic simulations improves the care between nurses and patients? 38% consider it positive, 15% very positive, 29% normal, 18% negative, we see that there is an assertive trend in that these advanced technology devices can contribute positively to the nursing profession to improve patient care. Very important in the formation of the future health professional. 5. Do you think that humanoid robotic simulations develop nursing student competencies? 50% positive, 18% very positive, 24% normal, 8% negative, we found 68% favorable among respondents, while 24% considered it normal, and with a very low percentage due to the acceptance that they do not develop competences with these types of robot. 6. Would this type of activities improve my learning in other subjects of

Figure 4: (Color online) Analysis of statistics from the four Likert-type questions from student surveys about the user friendliness of and satisfaction with robotic simulation in the training of nursing. For each of these Likert items, a 1 indicated a low value and a 5 indicated a high value.
the career? 41% positive, 15% very positive, 35% normal, 9% negative, we see that the majority gave a positive favorableness to the applicability that can be given to this type of robot practice. An analysis of open-ended questions was also conducted to determine the student’s perception of the interaction with the robot for their nursing training (questions from 7 to 10) or at least any trends. In terms of student’s responses, common comments were that they felt had good interaction with students using the technology, enjoyed working with high technology, felt it was a very positive learning experience, and felt the potential for using this robot technology in nursing education was good (ver Fig.4). 7. Do the activities carried out allow me to develop
tools and materials handling skills? 56% positive, 18% very positive, 17% normal, 6% negative, 3% very negative. 8. Do I enjoy doing this kind of activities with humanoid robots/simulators? 41% positive, 21% very positive, 24% normal, 15% negative. 9. Was the laboratory activity with a robot/simulator motivating? 38% positive, 18% very positive, 26% normal, 15% negative. 10. Could the effectiveness of the humanoid robot/simulator improve care for patients who require different types of care? 41% positive, 21% very positive, 29% normal, 9% negative, 62%. From the results obtained, it can be predicted that these types of robot activities are positively enjoyed by students who also include motivation and greater effectiveness in the development of syllabus.

The answers regarding the student’s perceptions (utility, effectiveness, kindness and satisfaction) were combined to determine a general analysis of the acceptance about of robot-humanoid technology in the clinical practices of nursing students Fig. 5. We found also that this method of study are favorable and shown a need continue to explore this technology as a viable teaching-learning strategy to expand the reach of expert nursing faculty.

3. Conclusions

Likert-type scales are typically used in medical education research. Common uses include end-of-rotation trainee feedback, faculty evaluations of trainees, and assessment of performance after an educational intervention. A great number of educational research manuscripts submitted to journals in medical education employ a Likert scale for part or all of the outcome assessments. This research reflects the perception of the students facing nursing robotic today in the Magdalena University. We reported a high acceptance of the robot. The initials results of this study are favorable and reflect a need to continue to explore this technology as a viable teaching-learning strategy to expand the reach of expert nursing program. There is no doubt that methods, processes and principles of the constructivist education have their indispensable place in the educational institutions and complement properly the other, generally utilized concepts, nevertheless, who wish to utilize this educational method, may profit from the potential of ICT and robotics, with the aid of which it is easy to realize many activities more easily and with excessively better results. We obtained very useful interpretation and analysis of data derived from Likert scales which has become an imperative tool for working in medical education and education research.

Acknowledgments

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