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ROBOTS IN EDUCATION: A JORDANIAN UNIVERSITY CASE STUDY

ROBOTS EN EDUCACIÓN: EL CASO DE UNA UNIVERSIDAD DE JORDANIA

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ABSTRACT

This paper adopts a technology acceptance model used for studying Robot's acceptance and focuses on the acceptance of robotic technologies. Despite a wide range of studies on the acceptance and usage of robotics technologies in different fields, there is lacuna of empirical evidence on the acceptance of robotics technologies in the educational context. We contribute to the scholarship on robotics technologies in an educational context, by using qualitative semi-

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structured interviews, and proposing a research model to empirically explore the main factors affecting the acceptance of robotics technologies, and particularly among university students. We contribute to practice by offering insights on users' expectations and intentions toward the potential use of robot services to both robot developers, and educational institutions alike. The results revealed a potential impact of effort expectancy, performance expectancy, social influence, and facilitating conditions on the intention behavior towards using robots as academic advisors. Additionally, an emergent dimension (i.e. emotions) was found to have an influence on the behavioral intentions, via its proposed impact on performance and effort expectancies. Overall, social characteristics of robots ought to be considered when investigating their acceptance, specifically when used as social entities in a human environment.

KEYWORDS
robot, technology acceptance, robotics technologies, educational context

RESUMEN
Este trabajo adopta un modelo de aceptación de tecnología utilizado para estudiar la aceptación de los Robots y enfocándose en la aceptación de las tecnologías robóticas. A pesar de una amplia gama de estudios sobre la aceptación y el uso de tecnologías robóticas en diferentes campos, existe una laguna de evidencia empírica sobre la aceptación de tecnologías robóticas en el contexto educativo. Contribuimos a la investigación sobre tecnologías de robótica en un contexto educativo, en particular en un contexto universitario, mediante el uso de entrevistas cualitativas semiestructuradas y proponiendo un modelo de investigación para explorar empíricamente los principales factores que afectan la aceptación de las tecnologías de robótica, y particularmente entre los estudiantes universitarios. Contribuimos a la práctica ofreciendo ideas sobre las expectativas e intenciones de los usuarios hacia el uso potencial de los servicios de robots tanto para los desarrolladores de robots como para las instituciones educativas por igual. Los resultados revelaron un impacto potencial de la expectativa de esfuerzo, la expectativa de rendimiento, la influencia social y las condiciones facilitadoras en el comportamiento intencional hacia el uso de robots como asesores académicos. Además, se descubrió que una dimensión emergente (i.e. las emociones) influye en las intenciones de comportamiento, a través de su impacto en el rendimiento y las expectativas de esfuerzo. En general, las características sociales de los robots deben considerarse al investigar su aceptación, específicamente cuando se usan como entidades sociales en un entorno humano.

PALABRAS CLAVE
robot, aceptación tecnológica, tecnologías robóticas, contexto educativo

INTRODUCTION

Robots' ability for autonomous mobility and performing a set of tasks had been captured by writers' imaginations. But recently, robots have emerged from the pages of science fiction novels into the real world (Graetz & Michaels, 2015). Different types of robots were developed, such as industrial, mobile, educational, collaborative, and service robots (Park & Pobil, 2013).

Robots were defined as mechatronic devices that can be programmed to do automatic procedures, or can be controlled through a computer-based mechanical interface (Diana & Marescaux, 2015). Consequently, the main feature of the robot lays in its ability to gather complex information and execute physical actions in a superior way. This ability enables the robot to replace, supplement, or even transcend human performance in various tasks (Taylor et al, 2016). This advancement in technology should not be seen as a threat, it represents a great opportunity for both individuals and society to improve welfare, especially in the fields where these technologies will be applied. Additionally, the relationship between robots and humans differ in nature from the relationship between humans and other machines. For instance, there are service robots designed to live with humans and to perform different types of tasks; defined as a set of mobile robots, designed to work in populated environments, such as hospitals, offices, restaurants, universities, museums, and homes. They are developed to perform different tasks, e.g. cleaning, education, learning, entertainment, and care (Bennewitz, 2004). For example, in the medical sector, the main idea of using robots is to improve patient safety and to perform surgical care remotely when needed (Haidegger et al., 2011). But, making the entire surgical procedure or a part of it, is imagined as a potential futuristic application of the robots (Pessaux et al, 2015). However, Educational robots are used, for instance, in language learning, teaching assistant, and the development of social skills (Cheng, Sun, & Chen, 2018).

The Human-Robot Interaction (HRI) is a scope of research concerned in evaluating, designing, and understanding of robot systems for use with or by humans. Communication between robots and humans is required to establish the interaction, and this communication could be done remotely (Humans and Robots are not in the same place) or proximate (Both are in the same place). With these types of communications, different interaction-based classifications are used for robots. These classifications related to social interaction, physical manipulation, and mobility. For example, proximate interaction with mobility will form robot-assistant systems. Additionally, empathy, sociability, and cognitive characteristics are associated with social interaction.

On the other hand, remote interaction with mobile robots is available in supervisory and teleoperation control applications (Goodrich, 2008). For instance, the applications of mobile robots have been growing widely for outdoor and indoor usage in different sectors, especially for the risky applications on humans, and in the places where it is difficult to be accessed by humans (Sharifi et al, 2016). Moreover, they are used in manufacturing, military applications, healthcare, search and rescue, security, and homes (Shneier & Bostelman, 2015). Actually, most schools, universities, and other educational institutions, especially in developed countries, have integrated technology and teaching techniques into their institutions to improve educational outcomes. Furthermore, computers, projectors, monitors, mobiles, and tablets are used as aiding tools in education and learning in different ways. The internet is used as an open-source and communication channel, and recently robots are used in classrooms for different tasks, e.g. for language learning, and telepresence; where teachers are communicating with the classrooms remotely, through the robot (Sharkey, 2016).

Despite a variety of studies on the acceptance and usage of robot systems in different fields, there is a lacuna of empirical evidence on the acceptance of robotics technologies in the educational context, due to the fact that these technologies are still under development. Which consequently, urged conducting this study, and proposing a research model to empirically explore the main factors affecting the acceptance of robotics technologies in an educational context, and among university students in particular. The researchers believe the proposed model will work as a base for future research in this context. While contributing to practice by offering insights on users' expectations and intentions toward the potential use of robot services in the educational context to robot developers and educational institutions alike.

LITERATURE REVIEW

Generally speaking, three types of factors can influence behavior decision: the positive or negative results associated with performing the behavior, agreement or disagreement of an influential person or group on performing the behavior, and the factors that may simplify or hinder the behavior execution. In the robot context, the first factor is related to the individual evaluation of using the robot, the second is related to the social influence, finally the third is related to the contextual aspect; which is crucial when using robots (Graaf & Allouch, 2013). Meanwhile, modern researches in human-robot interaction proposed that humans treat robots as a social entity with social roles and characteristics. In other words, humans see robots as human beings, especially when there is a direct interaction between them. Therefore, the design of robots should be social in its structure, to enable it to get involved in the human world (Young, 2010). For instance, in autonomous wheelchair robots, people are positively perceiving the ability of robots to call them by their names; which is an important aspect of human-robot interactions success and robot acceptance (Kanda et al, 2010).

Social robots can be used to perform social/service tasks (utilitarian) extensively, and build a long-term relationship through their interaction with human-beings (hedonic) (Klamer & Allouch, 2010). To give an example, social robots can be considered utilitarian systems, as they are designed to perform functional tasks, such as in healthcare, education, frontline services, while being considered as hedonic systems, due to the need of making a good and enduring relationships with humans in their environment (Klamer & Allouch, 2010).

In the same context, Uncanny Valley, which was introduced by Mori (1970), illustrated the differences between industrial robots (mostly utilitarian) and humanoid robots (utilitarian and hedonic). The author proposed a relationship between the degree at which an object looks like a human and the human emotional response to that object. He pointed to the functionally of the industrial robots, which is the most important aspect for the designers and it should match or exceed workers' functionality. However, industrial robots don’t look like humans. The author mentioned the possibility of making the robot with legs, arms, and face to look like a human, which in turn will increase the familiarity sense of humans toward robots.

Another important aspect proposed by Mori (1970), is the motion effect. He considered the motion as a sign of life. Additionally, when motion is programmed in such a way to look like human motion, the sense of familiarity will increase as well. Actually, familiarity with appearance and motion are representing the realism boundaries, and from the human perspective. But the author pointed to the degree at which the robot goes beyond realism boundaries, it might be perceived as unpleasant by humans. (Bartneck et al, 2009; Graaf & Allouch, 2013).

The utilitarian aspects of robotic technologies are related to the functionality and the required tasks from using such technologies. These aspects were well-studied in literature by implementing the technology acceptance models, such as the Technology Acceptance Model (TAM) for Davis (1985) and the Unified Theory of Acceptance and Use of Technology (UTAUT) for Venkatesh et al (2003) and their extensions. The TAM constructs perceived usefulness, which is defined as user perception of activities (e.g. work, home, and social tasks) enhancement by using robots, and the perceived ease of use, which is related to the simplicity and the free efforts that are associated with the use of robots. Both constructs are roughly corresponding to UTAUT constructs: performance expectancy and effort expectancy, respectively. These factors showed a significant impact on human-robot interaction (Graaf & Allouch, 2013). In fact, technology acceptance models have been deployed successfully in the robot acceptance literature. For example, Alaiad and Zhou (2013) used the UTAUT model constructs (i.e. performance expectancy, effort expectancy, social influence, and facilitating conditions) to study the intention behavior toward the healthcare robots. Social influence is defined as “the degree to which individuals perceive that important others believe they should use the new system” (Venkatesh et al, 2003, p.451). Moreover, facilitating conditions are defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system” (Venkatesh et al, 2003, p.453). Alaiad and Zhou (2013) research results showed that the four constructs are positively related to the behavior intention toward using robot technologies. The same findings were confirmed by Alaiad, Zhou, and Koru (2013) and Alaiad and Zhou (2014), except for the effort expectancy, which showed an impact on the performance expectancy, not on the behavioral intention. However, some studies confirmed the direct relation between effort expectancy and behavior intention(Graaf & Allouch, 2013; Heerink et al, 2010a).

Furthermore, the literature on the hedonic side of robotic technologies pointed to enjoyment and attractiveness as major variables in the acceptance of this technology. Enjoyment itself can be defined as the pleasure associated with robots' use (Heerink et al, 2010b). In this context, feeling enjoyed when using robots could be reflected positively on the acceptance of it (Shin & Choo, 2011). The enjoyable human-robot interaction is related to make humans more familiarized with this type of interaction. This enjoyable interaction can be achieved via the utilization of human propensity to interact with social entities or to provide robots with the ability to express their emotions by e.g. vocal communications (Romportl, 2015). Attractiveness can be related to robot appearance (Lee & Nass, 2003).

In universities context, in particular, little is known about the acceptance of robotic technologies among students. However, different studies have been investigating the new technologies acceptance in universities; by applying the technology acceptance theories. For instance, Escobar and Monge (2012) studied the acceptance of Moodle platform technology, which is a web-based platform used in e-learning activities. The authors applied the TAM model, and their results showed a significant impact of perceived ease of use and perceived usefulness on intention behavior toward this technology. In the same context, effort expectancy, performance expectancy, and social influence had been used in investigating the intention to use mobile learning (m-learning) technologies by Park, Nam, and Cha (2012). The authors confirmed the impact of these constructs on the acceptance of m-learning technology among higher education students. In fact, most of the previous studies about the new technologies acceptance among university students have successfully deployed the acceptance models in their investigations. Generally speaking, the differences in their results could be related to the significant level of said constructs' impact on behavioral intention (e.g. Chang, Yan, & Tseng, 2012; Sánchez & Hueros, 2010; Shroff, Deneen, & Ng, 2011).

The acceptance of emerging technologies in educational institutions continues to be problematic for them, even though its use has been increased in recent years, the use of such technologies is offering flexibility and simplicity in the educational practices' enforcement. Hence, the designers of new technologies and the decision-makers who are intending to implement these technologies in their institutions should focus on the drivers that stimulate intention, and actual usage behaviors of these technologies (Shroff et al., 2011).

Since robots are considered emerging technologies, this research will investigate the proposed intention toward using them in a Jordanian university setting as an academic advisor, based on the model introduced by Alaiad and Zhou (2013) in studying the acceptance of healthcare robots. This paper adopted a qualitative method to analyze the influence of effort expectancy, performance expectancy, social influence, and facilitating conditions on the intention toward using the robot as an academic advisor; which is in line with the previous studies about the new technologies acceptance in the educational context (e.g. Cheung & Vogel, 2013; Tarhini, Hone, & Liu, 2015) and the studies about the acceptance of social robots (e.g. Fridin & Belokopytov, 2014; Heerink, 2010; Heerink et al, 2009).

METHODOLOGY

The present study is based on a qualitative, exploratory, social constructivist, interpretive philosophy, using a case study design, and adopting mainly an inductive and abductive approach. A deductive initial research framework is developed based on the literature review; the framework is deductive but mainly with an exploratory purpose; as the constructs under investigation were not clearly established in the literature. The researchers used qualitative semi-structured interviews, to better understand the perceptions of participants about the acceptance of robotic technologies in a Jordanian university case study.

Research design

This paper utilized Semi-structured interviews were as the main method for the data collection; to gain a rich understating from the proposed users (university students) while avoiding any potential misdirection or interruptions. This method was supported by Crane (1997) to contribute insights and fresh ideas to this scope. The interviews' open-ended questions were developed based on statements and measurement scales adopted in previous studies (Alaiad et al., 2013). To avoid bias, students in different years of study and majors have been involved in the interviews. Overall, 13 interviews were conducted.

It is noteworthy that, we were open and flexible to the number of interviews to be conducted, but after the 10th interview we discovered that we were getting the same information, and the information we gained from the 13th interview added little to what we had already collected, this suggested Saturation, where additional data no longer discovers something new; as in qualitative research, the number of people that need to be interviewed cannot be known before theoretical saturation is reached (Bell, Bryman, & Harley, 2018).

Data analysis

This study is exploratory in nature. The data analysis was conducted by utilizing a systematic approach to new concept advancement and grounded theory articulation, in order to bring 'qualitative rigor' in inductive research (Gioia, Corley & Hamilton, 2013). In order to inductively induce new concepts development, the researchers adapted a holistic approach to inductive concept development.

This approach has been furtherly developed by Corley and Gioia (2004); Corley (2004); Clark et al (2010) and Nag and Gioia (2012). In these studies, semi-structured interviews were used to obtain real-time and retroactive perceptions from individuals about the phenomenon of theoretical interest (Gioia et al., 2013).

Concepts to theory development

After transcribing the interviews, analyzing the data qualitatively firstly involved open coding via a line-by-line and sentence-by-sentence analysis and generated free nodes (Corbin & Strauss, 2014). The nodes were then categorized into more than 50 first-order categories, in this 1st-order analysis, which attempts to abide closely to participants' words, researchers made a little endeavor to refine categories, and introduced a large number of the categories at the beginning of the analysis, which were then further refined into 30 categories through an iterative process of analysis, reflection, comparison of categories and deleting/collapsing categories. The categories allowed the data to be structured and organized (Gioia et al., 2013). The categories were further organized under second-order categories. The categories were then analyzed for emerging patterns and themes, based on the constant comparison of categories to identify similarities and differences, similar to the axial coding concept of Anselm and Corbin(1998), while focusing special attention on the emerging concepts that might not have enough theoretical references across the literature. Subsequently, the researchers investigated whether it is possible to bring the emerging 2nd -order aspects closer to 2nd-order "aggregate dimensions", to be able to produce a data structure. Figure 1, demonstrates 1st-order, 2nd -order and aggregate dimensions respectively. The structure enabled the researchers to consider the data theoretically, while going through emergent data, concepts, themes, dimensions and the correlated literature; to check for newly emergent concepts (Gioia et al., 2013). Table 1 shows the Themes and Subthemes, Table 2 shows the emergent and nonemergent themes.

Table 1. Data analyses – Themes and sub-themes

Themes	Sub-Themes
Intention Behaviour	*Effort Expectancy* *Performance Expectancy* *Social Influence* *Facilitating Conditions* *Emotions*

Figure 1. Data structure

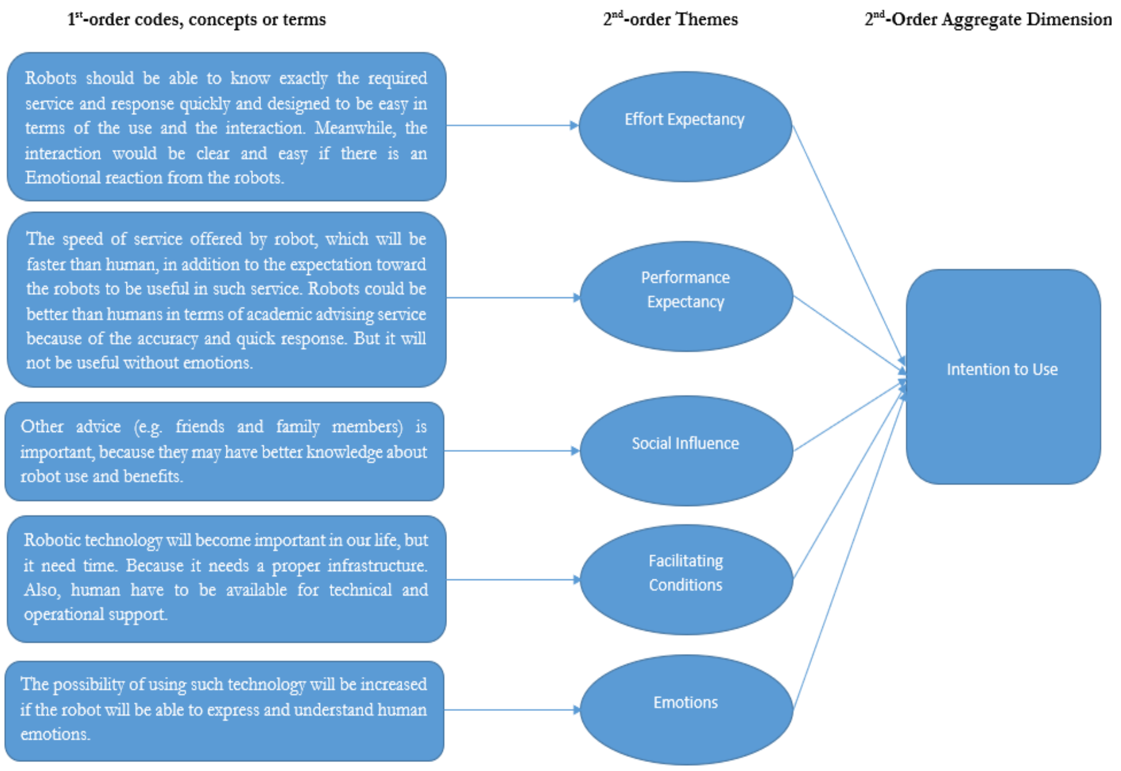


Table 2. Emergent and non-emergent themes

Emergent Themes and sub-themes from the interviews	Themes in the interview questions
Emotions	Effort Expectancy
	Effort Expectancy
	Social Influence
	Facilitating Conditions

RESULTS

The Effort Expectations of the interviewees towards robots were genarlly positive. Participant number 1 will be refferd to as (P1) and P4 believed that robots will be able to exactly know the required service and are expected to quickly respond. P2, P3, and P11 also believed that robots are designed to be simple in terms of usage and interaction. Additionally, some of the interviewees mentioned the importance of training, actual and frequent use, to make it easy for them to use robots. P2, P3, P5, P6, P10, P12, and P13 agreed about the possibilities of facing some difficulties in the initial use of the robots. However, they also agreed that it will become easy for them to use and interact with robots by training and after frequent use. Moreover, P5 pointed to familiarity with the technology of their generation, which could help them to act with robots easier than old generations. Furthermore, P9 considered human mood swings, in addition to the expected honesty of robots as preferences that will make robots better than humans. But the interaction could be clear and easy if the robots will have the ability to interact emotionally with the students.

The interviewees confirmed the importance of performance expectancy on their intention toward using robots as university academic advisors. They agreed on the expected speed of service offered by robots, as being faster than humans. In addition to the expectations toward robots to be useful in the anticipated service. P1 mentioned that humans can be distracted by other things while advising, but on the other hand robots will not be distracted and will just serve. In other words, the robots’ availability will be more than human.The same point was mentioned by P3, P5, P6, and P13. Moreover, P4 believed that robots will be better than humans in providing the academic advising service, due to high technological advancement, where machines unlike humans do not forget, with high accuracy rates when compared with humans. Furthermore, P5 referred to the possibility of incomplete information offered by humans. While P9 referred to the design, and P10 referred to the accuracy and speed of response. However, P8 and P10 mentioned the emotional dimension as the reason why they consider humans better than robots and pointed to the impact of emotions on the perception of robot performance.

Generally, interviewees confirmed the importance of social influence on their intention towards using a robot academic advisor, P2 and P4 considered relatives advice (e.g. friends and family members) important, because they may have better knowledge about robot applications and benefits. Meanwhile, P3 insisted on the priority of humans over robots, since humans can analyze and understand students' needs better than robots. Furthermore, P5, P6, P7, P8, P9, P11, P12, and P13 connected the importance of the relative’s advice to the personal conviction about the use and benefits of robots as an academic advisor. Nevertheless, P10 agreed to follow the relative's advice regarding robot use, because it will become available everywhere and will become a normal application.

P1, P5, P7, P9, and P11 considered human support as an integral part of the academic advising process, especially in failure and technical problems that could be associated with using such technologies. Also, P6 mentioned the importance of human academic advisors to be available as a backup plan in case robots fail to give the required service, and P13 gave the priority to the support from the human, especially in the beginning. On the other hand, P3 assumed that robots will have the ability to talk and to retrieve students' information automatically and through the student ID, for instance. These abilities can be seen as a major motivator of the acceptance of the robot's technologies in educational practices.

P3 considered the user manuals as an important tool to get knowledge on how to use the robot. P10 referred to the actual use as a source of gaining knowledge about using robots. Whilst, P11 considered understanding the purpose of using robots is necessary to know how to use it. In summary, the facilitating conditions could affect both intention and actual behavior toward such technologies.

With regards to the behavioral intention behavior dimension, P1 and P2, P4, P6, and P11 considered academic advising services offered by the robot as being better of those offered by humans, as they believed that robot performance will be better than human performance, e.g. reduction of the time of service execution (i.e. performance expectancy). In the same context, P2, P4, and P9 predicted that using the service offered by robots will be easy, so they will try to use academic advising services that will be offered by robots (i.e. effort expectancy). P2 also consider keeping track of technology advancement is the reason for trying such services. P3, P7, and P8 explained their intention toward using this service because it is a new technology and it is interesting and promising. P4 and P5 also believed that it will be available all the time. Likewise, P6 considered using such service, and technology is important since the developed countries are already using it and they are happy with that. P10 assumed that robot technologies will become critical in our life, but it needs time to be available as proposed by this research, as it requires proper infrastructure (i.e. facilitating Conditions). Finally, P12 and P13 expected to use this service, but in the long run.

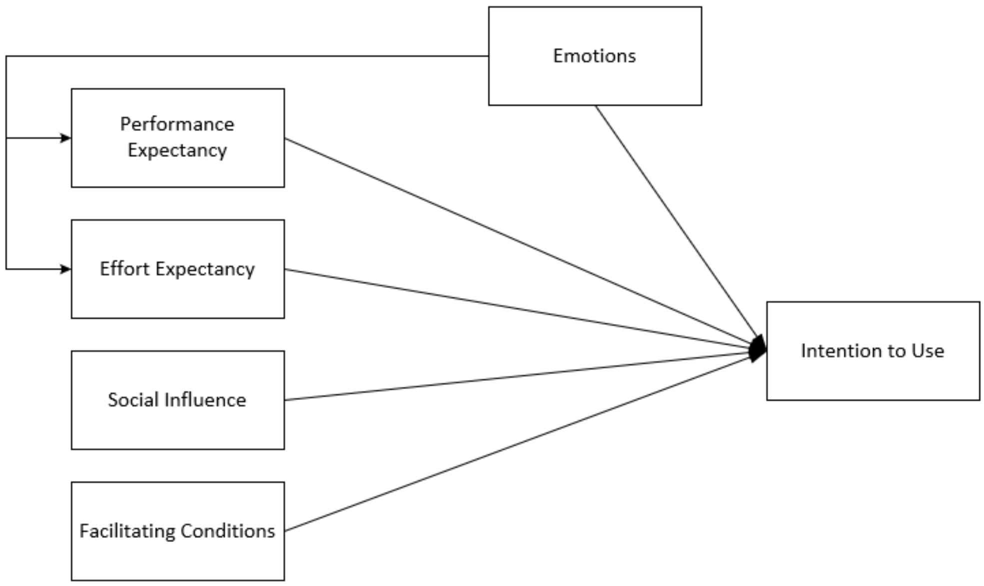
The emotional dimension has been presented in this study as an emergent dimension from the interviews. Some interviewees argued that the possibility of using robotic technologies will be increased if the robot will be able to express and understand human emotions. P9 linked the emotions to the clear and simple interaction (i.e. effort expectancy) and P2, P8, and P12 linked emotions perceptions to the robot performance (i.e. performance expectancy).

DISCUSSION

The proposed model after analyzing the interviews is shown in Figure 2. The importance of performance expectancy and effort expectancy constructs have been shown across the interviewees' answers, which is compatible with the previous studies across the robots acceptance literature (e.g. Alaiad & Zhou, 2013, 2014; Graaf, Allouch, & Dijk, 2016; Mucchiani et al., 2017) and the technology acceptance literature in the educational sector (e.g. Cheung & Vogel, 2013; Park et al., 2012; Tarhini et al., 2015).

However, the emergent construct was the emotional dimension, which emerged across the interview's questions about the effort expectancy, performance expectancy, and general questions. Accordingly, emotions could be seen as an important driver of robot technologies acceptance, especially in social settings. In this context, robots are expected to be able to express emotions through, for instance, facial expressions (Andreu et al, 2017; Timms, 2016; Wu & Bartram, 2018; Xu, Min, & Xiao, 2014) and to understand humans emotions while interacting with them, such as anxiety, positive emotions, negative emotions, pleasure, arousal and dominance (Graaf et al, 2016; Graaf, Allouch, & Dijk, 2019; Groom et al, 2009; Heerink et al, 2010b). Actually, most of the interviewees pointed out the ability of the robots to understand and express the emotions (e.g. P1 said "*Humans are better because they have emotion, I can show them my emotions and they can understand it. While Robot can't*").

Figure 2. Resulting research model



Most interviewees have been referring to the impact of the relatives' advice on their intention toward using robot technologies. which is in line with previous researches result (e.g. Alaiad & Zhou, 2013; Hossain, Quaresma, & Rahman, 2019; Lu, Papagiannidis, & Alamanos, 2019; Wagner, Nimmermann, & Schramm-klein, 2019).

Additionally, the facilitating conditions also got reasonable attention from the interviewees, especially the part related to the availability of technical support and knowledge resources (e.g. training and user manuals). Meanwhile, the interviewees proposed that no need for technical resources to be able to use the robot, because they are expecting it will be the same as human-beings (e.g. P3 considered that "*Robot should be able to talk, able to retrieve my information by my university ID*"). As a result, the interviewees agreed about the importance of facilitating conditions in the intention toward using the academic advising service by robots, which is compatible with the previous studies about robot technologies acceptance (e.g. Alaiad & Zhou, 2013, 2014; Alaiad et al., 2013; Conti et al, 2015; Fridin & Belokopytov, 2014; Heerink et al, 2009a; Wagner et al., 2019).

LIMITATIONS AND FUTURE RESEARCH

Further investigations in different universities and countries are required to understand the impact of cross-cultural differences. As this study is qualitative in nature, a quantitative method to validate the proposed model is required in the future. Meanwhile, some aspects should be involved while investigating the acceptance of the robot as an academic advisor, which have been mentioned by some of the interviewees, such as verbal ability, the differences of users perception toward robots according to their age and academic level, privacy concerns of the robot users and its impact on their acceptance of robot technologies, robot ability to interact socially with users and its impact on the user perception and acceptance of the proposed services.

CONCLUSION AND IMPLICATIONS

This study has utilized the model developed by Alaiad et al. (2013) in studying the acceptance of the robot as an academic advisor among university students. The interviews' questions had been developed based on the measurement scale used by the aforementioned model to better understand the impact of the model constructs on the intention toward robotics technologies, especially in this proposed application. In addition, the qualitative approach which had been utilized by the researchers enabled them to understand the impact of each construct on the acceptance of robotic technologies. This research showed a potential impact of effort expectancy, performance expectancy, social influence, and facilitating conditions on the behavioral intention toward using robots as academic advisors. Moreover, results showed a proposed direct impact of the emotional dimension on the intention to use robot advisor and indirect impact through effort and performance expectancies.

Furthermore, the emotional dimension represented the emergent dimension from the interview's analysis; as pointed out by some interviewees, the social characteristics of robots should be considered while investigating the acceptance of them, especially when used as social entities in the human environment. Emotions, verbal abilities, ability to be involved in a conversation, and the ability to understand user feelings and needs are some of the human abilities that interviewees considered crucial in order to accept robots instead of the human academic adviser, side by side with the technological aspects.

Finally, the research results will enable the decision-makers who are interested in utilizing robot's technologies within their institutions to understand the needed aspects that should be considered to guarantee a successful utilization of robots' technologies. In addition, conducting such research will improve society's' knowledge about the advancement and usage of robotic technologies.

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