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Perceptions toward adopting virtual reality as a teaching aid in information technology

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Abstract The use of technological tools is increasing rapidly in all fields, especially in education, which has moved from pen, pencil, and books, to using interactive technologies to help impart knowledge and understanding. Recent years have witnessed students facilitating immersive digital technology. However, it remains a challenge to provide sufficient learning medias to higher education students. The lack of novel technologies in the learning process does not necessarily mean that the students' educational level will be affected, but it may result in the need for extra efforts from both students and instructors in some fields. In order to allow education to catch up with technology, technological tools need to be utilized in the educational process. Virtual Reality (VR) is considered one of the novel options to add value to the learning journey. VR enables students to discover and explore their own knowledge. Furthermore, it makes the learning process more interesting, which improves students' motivation and attention. To ensure the actual active use of VR technology when embedded in higher education institutions, various factors that influence the acceptance or resistance of the technology integration should be examined prior to technology integration: Students and teaching staff perceptions, institutional support, barriers of integration, motivation for integration, prior technology experience, etc. This paper aims to examine instructors' perceptions towards VR integration through a case study in a Faculty of Information Technology (IT) in a University in the Middle East. Respondents surveyed in this study consisted of faculty members. A quantitative method were used, an adapted questionnaire was distributed online amongst IT teaching staff assessing their views about the possibility of the implications of VR as teaching aid. Descriptive statistics were used to analyze the questionnaire data. Results obtained from the quantitative data revealed the instructors willingness to adopt VR systems as a teaching aid, their intention to incorporate it into the education process in the future, barriers to technology use, users prior knowledge in technology. The results also revealed that

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technology training may be maximized for the integration of VR technology. This paper concludes with recommendations to facilitate the use of VR technology as a learning medium.

Keywords Virtual reality · Information technology · And education

1 Introduction

Improvement of education is influenced by the delivery of information in an effective and engaging manner, the latter depending on the visualization techniques utilized. Efficient teaching requires delivering the right information in the right mode, however, teaching staff are faced with huge amounts of information that are poorly represented and lack practical engagement from students, which affects their comprehension and memorizing of the represented material. Utilizing current and emerging technologies has the potential to improve students' outcomes and minimize the effort associated with teaching process.

New technologies are developed all the time, and new education modalities are being introduced to us, and there is a growing trend in IT for the use of 3-Dimensional (3D) multimedia and Internet throughout the education field. The emergence of VR offers significant opportunities to advance the educational process. VR is "a collection of hardware such as Personal Computer (PC), Head Mounted Displays (HMDs) and tracking sensors, as well as software to deliver an immersive experience" (Hussein and Nätterdal 2015). The flexibility of use and the reduction in the cost of VR systems have resulted in a rising interest in the Virtual Environment (VE) in education.

There are numerous ways in which VR technology has the potential to assist learning (Falah et al. 2014). First and foremost, it allows students to visualize abstract concepts coupled with 3D demonstration aid views, which enable students to have an enjoyable and realistic experience by providing rich, interactive and engaging context. This degree of interaction in reality is often not possible due to distance, time, or safety factors. Furthermore, VR reduces the ambiguity of 3D representation on normal computer screens where Human-Computer Interaction (HCI) cannot be easily obtained, as VR provides the user with an opportunity to view large amounts of information by navigating throughout the 3D models. The aforementioned activities provided by VR technology support students' educational thinking and involve them actively in forming knowledge by experiencing hands on learning (Bricken 1991; Shim et al. 2003). This enhances students' ability to grasp, retain, and diffuse the gained knowledge amongst others.

Virtual reality has observed drastic advances in many fields, including but not limited to: healthcare, manufacturing, scientific visualization, engineering, tourism, military, and education (Alfalah et al. 2013, Falah et al. 2014, Guttentag 2010, Mujber et al. 2004,). In education, educators have shown willingness to adapt computer-based applications in medical-school curricula to supplement, or in some cases replace, traditional teaching modalities such as textbooks, lectures, and laboratories (Nicholson et al. 2006). There is evidence that VR can offer an effective medium that enhances the performance of students in some fields; this was clearly shown in a comparative study conducted between one of the traditional anatomy teaching methods (physical model) and a virtual reality system for teaching the anatomy of the heart (shown in Fig. 1). The quiz results of the students who explored the VR heart anatomy system were much better than those of the students who used a physical model for learning (Falah et al. 2015).

One of the appeals of implementing VR in education is that it can add value in any field were experiments in real life cannot be carried out due to safety concerns. Within these limits, VR can create any imaginable scenario and let the learner become part of it (Bricken 1991), such as in medical training, simulated construction, flight simulators, and in engineering where engineers are able to design projects in 3D before implementation to reveal any defects and avoid potential risks (Alfalah et al. 2013; Falah et al. 2014; Falah et al. 2015; Huang et al. 2016; Shim et al. 2003).

However, like any other new technology VR might be faced with concerns when it is applied in new fields or environments. These concerns fall into the categories of usefulness and acceptance (Hussein and Nätterdal 2015). Further studies explored the technical and cultural challenges that face VR when used in education and training, such as cost, usability of software and interface devices, fear of technology, and learners' attitude toward VR and their willingness to incorporate it in their learning (Bricken 1991; Falah et al. 2015; Huang et al. 2016). It is crucial to examine the VR system usability by learners, instructors, and by curriculum developers as well as their acceptance of the technology. Fear of technology might lead to misuse of VR and hinders its utilization in aiding education. Hence, to facilitate embracing VR technology, the user should be provided with accurate information about VR prior to implementation, where science should be separated from fiction. Furthermore, educators should be well prepared for the transfer of the learning process (such as preparing appropriate curricula), and be aware of the social and psychological impact of its use (Bricken 1991).

The aforementioned research has shown advantages of VR as an educational aid, and many universities have become aware of this impact and have provided their students with VR media for learning. However, not all students and instructors accept VR technology as a learning and teaching aid. Furthermore, due to the cost accompanying VR technology implementation in universities, learner and instructor's perceptions toward VR technology, and educational effectiveness demonstrations should be examined prior to implementing the VR medium. In IT faculties specifically, students might be aware of technologies such as VR more than other faculties since VR is taught

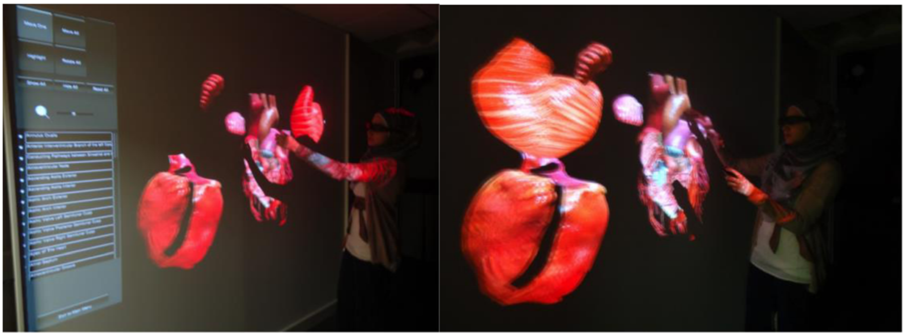

Fig. 1 Remote manipulation of 3D data in semi-immersive environment (projection wall and active stereo 3D glasses). (Glasgow Caledonian University/United Kingdom) (Adapted from (Falah et al. 2015))

as part of the curriculum in many IT faculties, however, this study focuses more on VR as a learning medium and not how VR is being taught.

2 Background

Emerging technologies that only came into common use over the last few years, including the Internet, e-mail, and video teleconferencing, are now becoming the standard tool for diagnosis, therapy, education and training. Advances in emerging technologies as in the development of 3D content opens the way for interactive 3D technologies to be used in the aforementioned fields. HCI can be enhanced with the use of immersive environments in the form of Virtual or Augmented Reality. As such, the VR environment offers a plethora of interactions imitating the real world. The term VR has many definitions which all mean that it is a computer-generated environment that allows people to explore and sometimes interact with its content.

VR systems are classified into categories; immersive virtual reality and non-immersive virtual reality, depending on the degree of presence provided, how immersed the user is into the environment, and how effectively the end users are focusing on the required task. Immersion or presence can be a concern. Generally there are a number of parameters for immersion presence including image complexity, stereoscopic view, and the level of interactivity and the update rate of display (Falah et al. 2012).

The concept of Immersion has been defined as "the physical configuration of the user interface of the VR application. Accordingly Virtual Reality applications are categorized into three categories: fully immersive, semi-immersive and non-immersive" (Gutierrez et al. 2008a). Fully immersive systems detach the user from reality using various HMDs. An example is shown in Fig. 2. One of the disadvantages of fully immersive systems is that individuals prone to motion sickness suffer this side effect when using HMD. Presence defined as "when the multimodal simulations (images, sound, haptic feed-back, etc.) are processed by the brain and understood as a coherent environment in which we can perform some activities and interact" (Gutierrez et al. 2008b).

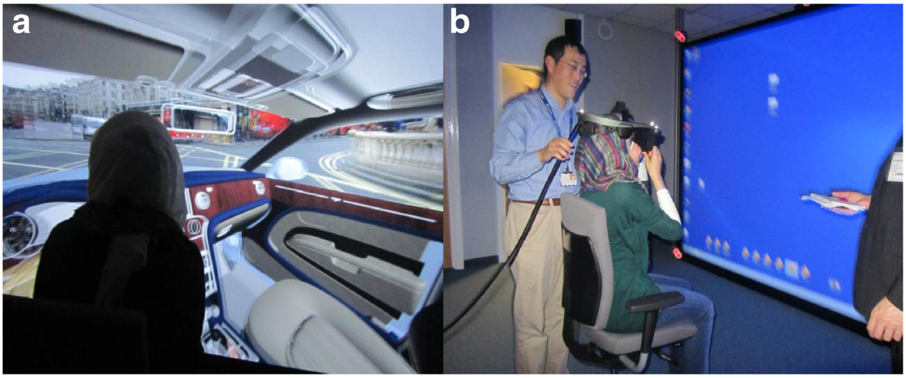

Fig. 2 Using head mounted display in virtual engineering center in University of Liverpool. (a) Shows how the user is fully immersed in the VE and (b) Shows the user putting on the head mounted display

Adhering to the abovementioned features of VR technology, it is evident that VR is also emerging as a very powerful educational tool; it opened the way to Second Life (SL), which uses 3D VR environments to create, simulated learning experiences. Previous studies explored SL educational potential and ability to support interaction and collaborative learning (Boulos et al. 2007; Skiba 2007). SL gives the users the chance to be well prepared for a certain event or situation by allowing them to access the virtual world anytime/anywhere from the Internet via an avatar that interacts with others and with the environment (Honey et al. 2009).

The high degrees of realism and believability offered by VR due to the use of high-speed 3D graphics as well as 3D audio provided VR with the potential to make a difference at various levels of education (Bell and Fogler 1995; Pantelidis 2010). Through its realistic exploration and manipulation of objects in the 3D virtual world it is widely believed that VR is capable of transform the educational process from being teacher-centered to being student centered (Riley 2008), which, in turn, utilizes constructivist learning theories by which learners "use their experiences to actively construct understanding that makes sense to them, rather than have understanding delivered to them in already organized form" (Polka 2001). Furthermore, VR enables students to "learn by doing" especially in authentic learning activities where implementation is difficult due to cost, complexity, or safety purposes. This active participation facilitates creating deeper knowledge and results in stronger comprehension (Riley 2008). Moreover, as students are actively engaged and participate in the VE, learners cannot be passive.

Another important aspect of creating knowledge is collaboration, were several learners can cooperate on resolving the same issue in VE; this provides a social atmosphere which facilitates collaborative learning (Antonacci and Modaress 2005). Furthermore, VR allows learners to progress through the learning material at a pace suitable for them, which cannot be done otherwise in reality. This provides equal opportunity of communication for learners from different backgrounds, disabled learners, and encourages pupils to play an active role in their education (Pantelidis 2010). Several studies focused on the effectiveness of VR for special need students, children, and young learners, and the results showed potential educational effectiveness of VE for the aforementioned groups of students. Furthermore, the majority of teachers intend to use VR technology if it was available, affordable, and easy to use by both instructors and learners (Roussos et al. 1999; Roussou 2004; Roussou et al. 2006).

Fostering discovery learning is another motive to consolidate VR technology in the learning process, where students explore the subject by actively experiencing and taking part in specific tasks. As simulation allow students to "explore new domains, make predictions, design experiments, and interpret results" (Steinberg 2000), students find it exciting and challenging to interact in 3D in contexts difficult to experience in real life, as students are able to walk through and around the 3D model. This active participation reinforces grasping and holding students' attentions (Pantelidis 2010). Moreover, previous research indicates that engaging students in VEs improves their skills; therefore, VE might act as a catalyst for change in students' self-efficacy (Ketelhut et al. 2007; Ketelhut 2007).

The benefit of applying VR technologies in a learning environment varies from one subject to another and from one person to another, but in general VR provides an active and immersive experience as well as promoting immediate user engagement, which is useful in our era of speed and limited attention spans, and enabling large and complex data to be visualized. However, to utilize the VR associated benefits we should know which subjects are appropriate for VR and which are not. VR should not be used when: VR cannot substitute the real thing, interacting in reality is essential, using VR could be damaging whether physically or emotionally, and when cost is not justified considering the expected learning outcomes (Pantelidis 1996). On the other hand, VR should be considered when: simulation could be used, teaching or training in reality is not safe or impossible, motivation whilst interacting with the 3D model is either equal or more than interacting in reality, cost of gathering required material in reality is higher, collaboration and shared experiences between learners is essential, the learning objective is met via simulation in VE, visualization and manipulation of 3D data are easier to understood, imitating reality for training is crucial and required to make the imperceptible perceptible, activities are needed that do not exist except in VE, it makes learning more stimulating, it gives equal chances for disabled individuals to do experiments and activities, and in situations where mistakes are not allowed by learners (destructive to environment, cause damage to equipment or costly, etc.) (Pantelidis 1996).

Despite all the benefits associated with integrating VR technology in education, there are challenges and barriers prevent using it as well. These barriers are primarily related to cost, learning new skills that most educators do not have which require them to spend extra time to learn how to use hardware and software, additional course preparation time, possible health effects, and facing reluctance to incorporate new technology into the curriculum (Pantelidis 2010; Riley 2008). But like any other new technology, each of the abovementioned barriers may diminish when VR becomes a more common technology and is employed in different areas aside from education (Pantelidis 2010).

This research aims to examine lecturers' expectations with regard to education in VR medium prior to its implementation, as well as the associated barriers that might hinder integrating VR in education. The term "expectation" is used here for predictive beliefs about teaching and learning in VR medium and not experience-based expectations (Higgs et al. 2005; Keskitalo 2012; Shewchuk et al. 2007). Several studies explored that technology adoption and diffusion by faculty members depends on their perceptions, beliefs, and attitudes toward the effect of utilizing this novel tool (Sugar et al. 2004a, b; Wood 2010).

Higher education institutions also encounter the challenge of engaging the technological savvy generation of students in the educational process and meeting their needs (Wood 2010). Over the past decade a number of studies have been undertaken to ascertain medical students' perceptions of their educational environment and their future medical practice (Adams O'Connell and Gupta 2006, Draper and Louw 2007,). And several studies examined the end-users (teaching staff and/or students) perceptions toward technology integration in education in different regions, which revealed that there is a strong correlation between the intention to use technology and the believe of usefulness of these technologies (Chen and Tseng 2012; Ottenbreit-Leftwich et al. 2010). Furthermore, several other variables can positively affect the attitudes and perceptions toward integrating technology in education such as teachers' training programs, available facilities, and prior knowledge in technology (Albirini 2006; Al-Ghazo 2008; Chen 2008).

Moreover, (Georgina and Olson 2008) surveyed faculty members in colleges of education to assess the correlations between technology literacy and pedagogical practice integration and the survey results revealed that there was significant correlation. In the same field, (John 2015) examined the faculty's attitude towards IT adoption in the teaching process via a web-based questionnaire based on the Technology Acceptance Model (TAM) and Diffusion Theory and results revealed that there are various factors that affect the acceptance or resistance of technology integration. Another study explored the correlation between several factors and technology integration (Gorder 2008).

In the field of language teaching (Ismail et al. 2010) investigated the perceptions through a questionnaire and focus group interview of the Arabic and English teachers as the success of technology integration in education highly dependent on attitude and support of the teachers involved, and results showed teachers' perceptions, their use and prior experience of technology and the barriers of technology integrations. Another study investigated instructors' concerns and perceptions of technology integration using similar methods resulted with recommendations for technology integration in that particular region (Ashrafzadeh and Sayadian 2015).

We used the findings from a number of studies (Alfalah et al. 2017; Nicolle and Lou 2008; Wood 2010) to assist in formulating a new study into IT students and educators' expectations and barriers of using virtual reality as a pedagogic medium.

3 Rationale

The previous research showed the importance of users' perceptions for the success or failure of technology integration in education. An exploratory study examined teachers' and students' perceptions of presence in virtual reality instruction (Jones et al. 2015). And in the field of IT education students' perceptions were examined towards VR integration as a learning medium (Alfalah et al. 2017). However, in IT education, there is only limited literature exploring lecturers' expectations of utilization of the particular technology 'VR' in teaching, whereas there was more research on perceptions of adopting technology in general (Straub 2009; Sugar et al. 2004a, b) and on students' embracing of virtual worlds (Adams 2007; Duncan 2005; Inoue 2007; Kluge and Riley 2008; Steinkuehler et al. 2008). Moreover, IT students learn VR as a technology but not as a learning medium, whilst integrating VR as an instructional tool will enhance the educational process (Antonacci and Modaress 2005; Bell and Fogler 1995; Pantelidis 2010; Polka 2001; Riley 2008). From this arises the importance of this study, which:

1. Explores instructors' awareness of VR technology in IT education;
2. Evaluates instructors' willingness to use VR technology as a learning medium if it was established;
3. And Explore the factors that affect technology integration and barriers that prevent incorporating VR in education.

4 Conceptual framework

In the field of virtual reality technology integration as a learning tool it is hard to find any models or theories that justifies the development of the application (Sánchez et al. 2000). However, (Sánchez et al. 2000) proposed a model that defends metaphorical design of educational VR systems, which is based on Lakoff and Johnson's theory of cognition. (Alfalah et al. 2017) adopted the aforementioned model and modified it to accommodate the purpose of their research, which was examining perceptions toward adopting VR as a learning aid in IT education, and they worked in their study on a group of the users "students". In this section, the architecture of examining the perceptions toward VR as a learning medium is adapted from (Alfalah et al. 2017) and the study will be on the instructors. This model is a useful reference framework for designing and embedding VR in any pedagogical program as an educational technology. Figure 3 shows the adapted model as follows:

User perceptions – The perceptions of the system users toward adopting VR technology as a learning medium: the first group of users "Students", and the second group of users "Instructors".
Source knowledge – Represents all the concepts, skills, to be learnt by the student.
Real Environment – The setting in which teaching takes place.
Materials – Represent didactic materials and information related to the subject.
System Development – The actual implementation of the VR system.
Educational VR system – VR system for IT education as a learning medium.

5 Methodology

It is intended that the proposed technology suggestion will enhance the education process and move it beyond traditional modalities to interactive ones. The utilized data will encapsulate a plethora of multimedia information aiming to enhance teaching process, this paper will go through the theoretical part of examining instructors' expectations toward VR technology through the use of quantitative method. The

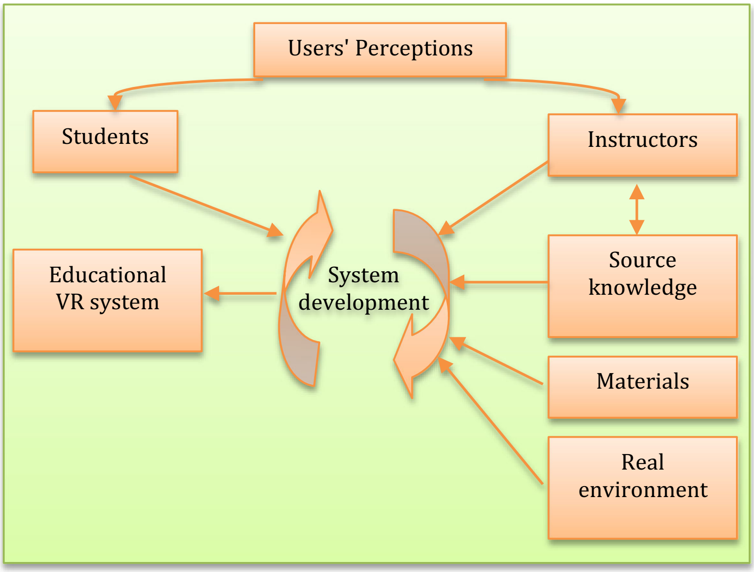

Fig. 3 Educational VR system model (Adapted from (Alfalah et al. 2017))

obtained descriptive statistics assess faculty members' willingness to embed VR technology into the learning process.

5.1 Population

This paper examines the second group of the system users' (Instructors) perceptions toward adopting VR technology as a teaching medium. The case study of this research was the instructors of Information Technology faculty in the Middle East. A sample of higher education faculty members was selected. The type of sampling used was random sampling, with e-mails sent to faculty members containing the URL of the survey. Population size was 30 faculty members. The faculty members who completed the web-based survey with a response rate of 36% determined respondent's number.

5.2 Instrumentation

The methodology is the result of a questionnaire distributed online amongst IT teaching staff. The questionnaire survey was carried out to understand the current instructors' perceptions toward VR technology, its importance, and applicability as a learning medium. The survey area consists of 25 questions (divided into the following categories: demographics, general attitude toward technology and VR, knowledge in VR, barriers to technology integration, and available resources) adopted from (Alfalah et al. 2017; Wood 2010; Nicolle and Lou 2008). However, to customize the questionnaire for this research, some parts of the original surveys were omitted, others were amended, and some new sections were added. The obtained results formed instructors' perceptions toward VR technology and their willingness to adopt VR technology as a teaching medium if implemented.

5.3 Data analysis

5.3.1 Statistical treatments

To answer the questions of the study, the quantitative data was analyzed using SPSS (Statistical Package for Social Sciences), then made the necessary statistical analyzes.

5.3.2 Verify the authenticity of the construction of the paragraphs of the trend towards the scale (construct validity):

The researcher verified the authenticity of the construction of the paragraphs of the trend toward scale material, and through the calculation of the correlation coefficient between the paragraph marks at the scale with the total score. Table 1. shows the values of paragraph correlation with the performance as a whole and statistical significance coefficient:

It is noted from the results of Table 1. that the correlation coefficients between the paragraphs of the scale with the overall performance values ranged from (0.78–0.97), furthermore, all correlation coefficients statistically significant at the level of statistical significance ($\alpha = 0.05$), which means accepting all paragraphs, this statistical procedure in favor of Validity construction of paragraphs measure, which enhances the action applied to a sample study definitively.

Table 1 Paragraphs correlation with the overall performance and statistical significance of coefficients values

Paragraph number in the Scale	The values of correlation coefficients	Statistical significance (Probability)
Items		
11	0.79	0.00**
12	0.87	0.00**
13	0.78	0.00**
14	0.85	0.00**
15	0.89	0.00**
16	0.81	0.00**
17	0.90	0.00**
18	0.93	0.00**
19	0.90	0.00**
20	0.97	0.00**
21	0.96	0.00**
22	0.96	0.00**
24	0.92	0.00**
25	0.91	0.00**

**Meaning: statistically significant at the level of statistical significance ($\alpha = 0.05$)

5.3.3 Reliability (Cronbach's alpha):

The computation of the Reliability of the applicable questionnaire (attitudes scale) through the creation of internal consistency coefficient between paragraphs, as the value of Cronbach Alpha reliability coefficient (0.91), and this percentage is considered acceptable for the purposes of scientific research. Table 2. Shows the reliability coefficients values.

It is noted by Table 2. that all the values of reliability coefficients greater than (70%). These percentages are deemed acceptable for the purposes of scientific research.

The first eight questions in the questionnaire (Table 3) assessed demographic criteria, such as gender, age group, technology usage, courses taught, number of students enrolled in courses, years spent in teaching, and degree of integration and use of technological tools. It can be recognized that the majority of the staff members are familiar with using technology in education as 72.73% of staff members began using technology (e-learning, m-learning, multimedia, etc.) to instruct, prepare material or, present in class over five years ago. Furthermore, 81.82% began requiring technology use by their students to complete course related tasks 5+ years ago.

Table 2 Reliability Coefficients Values

Section	Number of items	Cronbach Alpha reliability
A (Items 11–19)	9	0.90
B (Items 20–22)	3	0.81
C (Items 24,25)	2	0.77
The Scale	14	0.91

Table 3 Analysis of general information questions

Question	Statements in the questionnaire or Answers	Frequencies	Percentage
1. What is your gender?	Female	2	18.18
	Male	9	81.82
2. What age group are you in?	25–30	0	0
	30–39	4	36.36
	40–49	1	9.09
	50–59	6	54.55
	Over 59	0	0
3. Your faculty position is:	Assistant Professor	5	45.45
	Associate Professor	2	18.18
	Full-time instructor	2	18.18
	Part-time instructor	0	0
	Professor	2	18.18
4. What courses do you typically teach?	Database Systems, Game Development, Web Development, Introduction to Programming, Mobile Applications Development, Cloud Computing, Multimedia Systems, Human Computer Interaction	2	18.18
	Databases	4	36.36
	IT courses	2	18.18
	IT project management	2	18.18
	Security and programming courses	1	9.09
5. The average number of undergraduate and/or graduate students whom I teach in one semester is:	100	2	18.18
	20	2	18.18
	35	2	18.18
	50	2	18.18
	60	1	9.09
	90	2	18.18
6. How many years have you been teaching in higher education?	Under 1 year	2	18.18
	1–5 years	0	0
	6–10 years	2	18.18
	11–15 years	1	9.09
	16–20 years	0	0
	Over 20 years	6	54.55
7. I first began using technology (e-learning, m-learning, multimedia, etc.) in my teaching preparation or class presentation:	6 months ago	2	18.18
	1–2 years ago	0	0
	3–4 years ago	0	0
	5+ years ago	8	72.73
	Not applicable	1	9.09
8. I first began requiring technology use by my students for course assignments:	6 months ago	2	18.18
	1–2 years ago	0	0

Table 3 (continued)

Question	Statements in the questionnaire or Answers	Frequencies	Percentage
	3–4 years ago	0	0
	5+ years ago	9	81.82
	Not applicable	0	0
9. The stage that best describes where I am within the technology adoption and integration into teaching process is:	Awareness.	0	0
	Learning the process.	0	0
	Understanding and applying the process.	5	45.45
	Creative application to new contexts.	2	18.18
	Facilitating the process.	4	36.36

For the second group of questions about instructors' general attitude toward technology and VR Tables 4 and 5 show the obtained results.

The results in Table 5 indicate that the majority of instructors use multimedia technology tools while preparing their courses as they view effective technology incorporation into the course as having a positive impact on students' learning within their disciplines (questions 11 and 12). Furthermore, respondents had quite high expectations with regard to students' learning efficiency when they were given the chance to engage with the material and formulate their unique educational pathway (M = 4.54; SD = .522) (question 14). Furthermore, results also confirmed that instructors believe that embedding VR technology into the education process provides a medium were the students can immerse themselves into the material they wish to learn, which allows the learners to engage with their studies as they navigate through the provided environment which promotes discovery learning and students self-confidence (questions 16–18).

To achieve the goals of the study the scale attitudes were designed from the Likert five-point scale (1 through 5 respectively) Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

To determine the level of assessment of the study sample paragraphs that questionnaire was considered the Follows:

The Mean (4.21–5.00) the degree of Strongly Agree (SA).
The Mean (3.41–4.20) the degree of Agree (A).
The Mean (2.61–3.40) the degree of Neutral (N).
The Mean (1.81–2.60) the degree of Disagree (D).
The Mean (1.00–1.80) the degree of Strongly Disagree (SD).

For the third group of questions (Table 6), which examines the knowledge of the respondents in VR, the majority of the respondents did not think that it is difficult to obtain a VR device (M = 2.81; SD = .981) (question 20). The results show that instructors' knowledge with regard to the benefits associated with the use of VR as a teaching aid in IT education were moderately high (M = 3.90; SD = .700) (question 21).

Table 4 Analysis of questions about attitude toward technology and VR

Question	Statements in the questionnaire or Answers	Frequencies	Percentage
10. The motivation for technology integration is (Multiple selection):	- I think technology integration into teaching process will benefit my students thus I see it as a welcomed challenge.	7	63.64
	- I think technology integration into teaching process will benefit my students thus I see it as a welcomed challenge. - I feel more confident when I learn new technology skills and embed them in my teaching.	2	18.18
	- I think technology integration into teaching process will benefit my students thus I see it as a welcomed challenge. - I feel more confident when I learn new technology skills and embed them in my teaching. - Other: It's my passion, a hobby, and my profession also.	2	18.18

The fourth group (question 23) shown in Table 7 examines the barriers that might hinder integrating VR technology in education from instructors' perspectives.

The last group of questions shown in Table 8, shows the impact of the support that the university provides (such as workshops and seminars) on technology integration.

Tables 5, 6 and 8 demonstrate Cronbach's alpha for each point, and the means and standard deviations of the sum variables. All Cronbach's alpha values were above 0.797 (0.797 to 0.876), which reflects reasonable internal consistency, and usability of the variables to describe instructors' expectations (Nunnally 1978).

6 Results and discussion

6.1 Research objective one: Explores instructors' awareness of VR technology in IT education

This research objective was designed, in part, to examine the level of instructor's awareness of VR technology. Firstly, instructors were asked about technology in general and the stage that they are within technology adoption and integration in teaching process. Most of the respondents use technology in teaching preparation or class presentation for 5+ years. And most of them as well are in the stage of "Understanding and applying the process" and "Facilitating the process". Secondly, instructors were asked if they use multimedia tools while preparing their courses and the degree of approval was "Strongly Agree". And thirdly, instructors knowledge in VR were examined, and the results showed that most of the respondents consider themselves 'Very" knowledgeable regarding the potential benefits associated with the use of VR in IT teaching as well as regarding the different current application of VR in education.

Table 5 Analysis of questions about attitude toward integrating VR into educational process, questions adopt the five-rated Likert type (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Reliability coefficients values whether the item is deleted in the scale using Cronbach's alpha coefficient

Questions	Mean	Std. Deviation	The degree of approval	Cronbach's Alpha if Item Deleted
Q11. Whilst preparing my course(s) I use multimedia technology tools.	4.54	0.820	Strongly Agree	.873
Q12. If technology was integrated in an effective way in the course(s) that I teach it will positively affect the student learning process.	4.90	0.301	Strongly Agree	.840
Q13. Using technology within my discipline encourages student-centered learning (shift the focus from the teacher to the student).	4.36	0.809	Strongly Agree	.801
Q14. I think that if students provided opportunities to manipulate objects and interact with content, they will learn most effectively since they had the chance to construct their own learning.	4.54	0.522	Strongly Agree	.840
Q15. I think embedding VR technology within my discipline will enhance collaborative learning.	4.18	0.750	Agree	.802
Q16. I think students will be engaged in the learning process by using VR technology in my course(s).	4.18	0.750	Agree	.802
Q17. Using VR technology within my discipline can enhance discovery learning.	4.18	0.750	Agree	.802
Q18. I believe that students' immersion in virtual environment in learning process promotes their self-confidence.	4.54	0.522	Strongly Agree	.840
Q19. I intend to use VR as a learning medium in teaching if the required facilities were offered.	3.81	1.470	Agree	.793
Total	4.36	0.74	Strongly Agree	

The aforementioned results show the instructors proficiency of using technology in general, their knowledge in VR devices, and their awareness of VR benefits and applications as an educational tool. It is envisioned that faculty members with concrete knowledge in technology are more apt to integrate new technologies into courses design and delivery (Georgina and Olson 2008). Whilst in other study (Ashrafzadeh and Sayadian 2015) although teachers believe that technology integration is advantageous, they think that technology integration is difficult to understand and use, these perceptions can cause slow adoption of technology.

6.2 Research objective two: Evaluates instructors' willingness to use VR technology as a learning medium if it was established

Another way to look at this objective is to ask, do faculty members believe that VR integration in education will enhance the education process? And if they intend to use VR as a learning medium if the required facilities were offered? The results of the analysis (Table 5) clearly show that faculty members believe that integrating VR in education will positively affect the students learning process, encourages student-

Table 6 Analysis of questions about users' knowledge in VR, questions adopt the five-rated Likert type (1 = Not at all, 2 = Slightly, 3 = Somewhat, 4 = Very, 5 = Extremely)

Questions	Mean	Std. Deviation	The degree of approval	Cronbach's Alpha if Item Deleted
Q20. How difficult do you think it would be for you to obtain a VR device?	2.81	.981	Somewhat	.802
Q21. How knowledgeable do you consider yourself to be regarding the potential benefits associated with the use of VR in IT teaching?	3.90	.700	Very	.861
Q22. How knowledgeable do you consider yourself to be regarding the different current application of VR in education?	3.54	.820	Very	.876

centered learning, learn to construct their own learning, enhance collaborative and discovery learning, and promotes self-confidence. These findings are in line with those of other studies (Alfalah et al. 2017; Burkle and Magee 2018; Falah et al. 2015; Freina and Ott 2015; Pantelidis 2010; Peters et al. 2016; Polka 2001; Riley 2008; Steinberg 2000) in which they also confirmed on advantages of VR technology integration in education. The degree of approval of faculty members on their intention to use VR as a learning medium in teaching is "Agree", and this is consistent with previous work (Ashrafzadeh and Sayadian 2015) in which the greater the relative advantage the more expected technology is to be adopted.

6.3 Research objective three: Explore the barriers that prevent incorporating VR in education

This research objective was designed, in part, to examine the barriers that might prevent integrating VR technology in education. And the factors that affect technology integration such as workshops, seminars, and informal network of friends/colleagues. As shown in Table 7 the faculty members concerns lie in: how to integrate VR technology within disciplines and its appropriateness to specific disciplines, cost of embedding VR technology, the required learning and preparation time for the courses, the limited administrative support for integrating technologies, and the lack of personal technological skills. The obtained results were consistent with previous studies (Pantelidis 2010; Riley 2008). But none of the faculty members considered the following three factors as barriers: relying on Software/Hardware to run the course, developing teaching methods, and students' distraction. On the other hand, faculty members believe that workshops and seminars provided by the institution are essential as a source of information in regard to incorporating technology in teaching, and an essential source of information for technology integration in teaching, is the informal network of friends/colleagues. Their degree of approval was "Agree" on these questions as shown in Table 8. Which is consistent with (Georgina and Olson 2008) study as most of the faculty members "strongly agreed" and

Table 7 Analysis of questions about barriers to technology integration

Question	Statements in the questionnaire or Answers	Frequencies	Percentage
23. I think barriers to integrate technology into educational process are:	- I do not know how to integrate virtual reality technology within my discipline. - I think that the cost of embedding VR technology in education would be a barrier.	2	18.18
	- Embedding technology into educational process needs too much of my class preparation time.	1	9.09
	- Embedding technology into educational process needs too much of my class preparation time. - Learning how to integrate VR technology within my discipline requires time, which I do not have.	2	18.18
	- Embedding technology into educational process needs too much of my class preparation time. - The administrative support is limited for incorporating VR in educational process.	2	18.18
	- Embedding technology into educational process needs too much of my class preparation time. - The administrative support is limited for incorporating VR in educational process. - I do not know how to integrate virtual reality technology within my discipline. - I lack the required personal technology skills to incorporate VR technology into teaching process. - I think that the cost of embedding VR technology in education would be a barrier.	2	18.18
	- The administrative support is limited for incorporating VR in educational process. - I think that VR technology is not appropriate for the course(s) I teach.	2	18.18
	- I cannot rely on access to essential software/Hardware (such as virtual environment software, 3D goggles) in order to use virtual reality technology in my course(s).	0	0.0
	- I do not think that my teaching methods need to be updated to adopt new technologies such as VR.	0	0.0
	- I think that incorporating VR in teaching will distract students.	0	0.0

"agreed" responding to the question about the university's responsibility to train the faculty members to use technology to enhance education.

7 Limitations

The purpose of this study is to examine faculty members' perceptions toward adopting VR technology as a learning medium in IT education. However,

Table 8 Analysis of questions about resources effect on technology integration, questions adopt the five-rated Likert type (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Questions	Mean	Std. Deviation	The degree of approval	Cronbach's Alpha if Item Deleted
Q24. Workshops and seminars provided by my institution are essential to me as a source of information in regard to incorporating technology in my teaching.	3.63	1.501	Agree	.806
Q25. An essential source of information for technology integration in my teaching is the informal network of friends/colleagues.	3.45	1.368	Agree	.797
Total	3.63	1.50	Agree	

certain limitations should be taken into consideration. This study was conducted with a limited number of participants located in one university covering a particular geographic region. Results should be interpreted carefully until further data from similar groups of participants in other educational establishments and regions has been obtained.

8 Conclusions

This research focused on providing a guidance model for adapting VR technology in the educational process. Furthermore, the research aimed to describe the expectations of IT instructors regarding VR as a learning medium, which is considered the first step in implementing the educational VR system model, and also explored their overall knowledge and experience with utilizing such technology.

For this purpose, the questionnaire was adopted from previous similar studies, and modified to achieve the goals of this research. The analysis of the questionnaire revealed that most of the respondents are familiar with the use of technology in teaching. The vast majority also requires technology use by their students. The justification for this is that most of the instructors view technology implementation as having the potential to have an enhancing impact on student learning within their disciplines, and encourages student-centered learning, as well as providing the chance to engage with the course material and formulate unique learning pathways. Furthermore, instructors advocate that utilizing VR technology as part of the teaching process will help increase collaborative learning, engage their students in learning, promote discovery learning, and achieve greater self-confidence.

The questionnaire also studied the instructors' knowledge about VR technology and showed that the majority did not think obtaining a VR device would be difficult, and that over all the students felt knowledgeable about VR technology's potential benefits.

The instructors' attitudes and thoughts about VR technology in the education process show a promising tendency towards accepting the utilization of this technology and its integration into the curriculum, hence, this research offers the foundation for the development of an educational model for VR and simulation based learning environments. Similar evaluation from the point of view of the students will be carried out in the future to incorporate their perceptions into the design of any proposed solution.

9 Recommendations

9.1 Recommendations for further study

Although this study has some contribution, the topic needs further examination to assess faculty members' perception toward integrating VR technology as a learning medium in IT education.

1. This study has provided a baseline data on faculty members' perceptions of VR technology integration in IT education. But it was limited to a particular geographic location and population. Other studies should be done on larger number of faculty members from different geographical areas.
2. Conducting qualitative interviews with faculty members will enrich the outcome of further studies by determining in-depth insights on best practices for VR technology integration.
3. More research should be done on specific disciplines within IT and the integration of VR into these particular disciplines and specific tasks.
4. More research to be conducted to determine the strategies for providing faculty members with effective training and professional development.
5. A similar study should be conducted to evaluate students' attitudes and perceptions towards VR technology as a learning medium.

9.2 Recommendations for practice

General recommendations to more effectively enable VR technology integration into teaching and learning:

1. Professional development programs require allocated time from faculty members. Therefore, time for training should be released.
2. The transform of the ordinary classroom to a VR medium requires special programs and training should be provided for faculty members on the advantages and the use of technology in the classroom.
3. Provide realistic and practical plan for the transform from traditional to new ways of teaching, accompanied by supplemental intensives to faculty members who are the most involved in technology integration.
4. Increase the awareness of faculty members about technology integration into education and its advantages via staff emails, learning management systems, seminars and posters.
5. Administrative support should reduce faculty members load while implementing new educational strategies.

6. Support collaboration between faculty members to share ideas about enhancing educational strategies (discussion group, email groups, etc.).

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