The Use of Augmented Reality of Students With Intellectual Disabilities in University Education: Faculty Members' Attitudes

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The purpose of the current study was to examine faculty members' attitudes toward the use of augmented reality with students with intellectual disabilities. a descriptive design to collect responses from 165 faculty members at Taif University. An adapted questionnaire with a 5-point Likert scale was randomly distributed through an electronic link after gaining the validation and reliability of over 25 participants. The results were descriptively and inferentially analyzed and showed that the majority of faculty members agreed on the use of AR for students with intellectual disabilities, but they neither agreed nor disagreed that the facilities and centers of Taif University have the essential infrastructure and tools to utilize augmented reality for students with intellectual disabilities. Also, younger faculty members with low academic rank have agreeable attitudes related to the use of augmented reality technology for students with intellectual disabilities. Recommendations and suggestions were discussed to increase the faculty members' attitudes on the use of augmented reality in university education.

Keywords: augmented reality, faculty members, intellectual disabilities, university education

INTRODUCTION

In the last few years, AR technology has been excessively employed to accommodate and include people with disabilities in their society (Cakir & Korkmaz, 2019). This technology was integrated due to the learning needs of students with disabilities to have educational environments based on inclusive education (Lindsay, 2018). AR applications accomplish this desire through mixed-setting learning, which reinforces the mixture of real and virtual objects (Chen et al., 2015) and gives varied immersion, engagement, and interaction for disability social support centered on physical and learning support and social living (Wu et al., 2013). AR applications have also played a considerable role in supporting learning among persons with disabilities and their skills, including self-determination, self-management, self-instruction, and navigation skills (Gomez-Puerta et al., 2019). AR benefits can be noted in higher education settings as being an influential tool in displaying educational resources (Benda et al., 2015; Smith et al., 2017), a reading assistant (Huang et al., 2019), developing daily living skills (Bridges et al., 2020), and vocational job skills (Chang et al., 2014) for students with intellectual disabilities (ID). Furthermore, instructors see AR as an innovative instrument to change instructional and teaching practices from instructing to self-teaching and from instructor-centered to learner-centered education (Salmi et al. 2012).

Augmented reality (AR) technology is an extension of virtual reality (VR) that has increasingly appeared in the field of education in recent years (Wu et al., 2013). Also, it provides many scenes from real life and improves learning environments in a more accessible way as it is based on teaching information

and interacting with it naturally. Moreover, it has a significant complementary educational effect as a computer-assisted learning tool and is more effective for low-achieving students (Wu et al., 2013).

The use of AR in higher education is not limited to students with low achievement; it can be a supportive tool for students with ID. Bridges et al. (2020) implemented an AR intervention for teaching daily living skills to three young adults with ID by using multiple baselines across behavior designs. They found the AR intervention effective in increasing independence among all adults. It also helps increase social acceptance and reduce the stigmatization of adults with ID in a residential college program.

Given the effectiveness of AR in supporting young people with ID in social acceptance, Montoya-Rodríguez et al. (2022) conducted a systematic study to investigate the effectiveness of AR or VR as strategies for teaching social skills. They found no scientific evidence confirming the usefulness of AR or VR in improving social skills for individuals with developmental deficits. However, they believed most studies lacked control groups, generalization results, and follow-up measures.

Apart from the usefulness of AR in supporting the social sides of students with ID, it can be helpful to support the practices of living needs of students with ID. McMahon et al. (2015) carried out a study that examined the impact of location-based AR navigation compared to Google Maps and paper maps as navigation aids for three college students with IDs. They mainly measured the ability of students to make independent navigation decisions when traveling to unknown business locations. They found that students traveled more successfully using AR than Google Maps and a paper map, and their navigation skills improved continuously (McMahon et al., 2015).

Navigation, or wayfinding, is a specific skill linked to navigation that requires individuals to make correct decisions when traveling (McMahon et al., 2015). According to a study conducted by McMahon et al. (2017) regarding the use of the AR iPhone app as a navigation skill for students with ID, they found those students improved their wayfinding skills when traveling by foot on a university campus in a convenient way. Also, students with ID could easily employ the iPhone, a common mobile device, without the restrictions of other assistive technologies that can be stigmatizing due to their appearance (McMahon et al., 2017).

Applications-based AR can also be employed in other daily living tasks, such as identifying food allergens, which are a major concern for individuals with ID (McMahon et al., 2013). Using mobile devices, including the Red Laser application, is helpful to find potential food allergens (McMahon et al., 2013). Although teaching the identification and maintenance of food allergens to students with ID could take six weeks, it is necessary to increase independent living skills for individuals with ID (McMahon et al., 2013).

AR in teaching courses for students with ID is increasingly used in higher education. It helps postsecondary students with ID acquire definition and classification knowledge for the new science terminologies (McMahon et al., 2016) and can be an alternate way for faculty members to teach students with intellectual/developmental disabilities to answer mathematical word problem questions (Wu, 2022). In addition, faculty members believe that AR can be an innovative educational resource that facilitates the learning of students with disabilities (Elfeky & Elbyaly, 2023). It can be an instructive technology by enhancing learning success, motivation, and desire for tasks (Iatraki & Mikropoulos, 2023; Küçük, Yýlmaz & Göktaþ, 2014), supporting the comprehension of information, and increasing orientation and the level of engagement (Gómez-Puerta et al., 2019).

The current issue is very essential to research, as faculty may support their students with disabilities by utilizing and believing in AR usage in higher education. However, AR learning designers must study the gap and support instructors and students to reduce barriers (Jdaitawi & Kan'an, 2022). Also, the above literature indicated a research goal of examining faculty members' attitudes toward utilizing AR for students with ID. Therefore, identifying faculty members' attitudes toward the use of AR by students with ID is essential in terms of originality.

The current study is significant as it provides faculty members with knowledge and practices about using AR with students with ID in higher education. It helps the AR designers understand the reality of faculty beliefs towards its use within lectures. This study adds knowledge to future studies regarding the use of AR by students with ID. More importantly, this study reinforces the concept of inclusive education for students with ID and their faculty. Consequently, interesting questions emerge, including: (1) What are

the faculty members' attitudes toward using AR with students with ID? (2) Are there statistically significant differences at (0.05) in the responses about faculty members' attitudes toward the use of AR in students with ID attributed to the variables of gender, age, and academic ranks?

METHODOLOGY

The current study used a descriptive design, which is appropriate to describe people by studying them as they are in their environments (Siedlecki, 2020). Due to the variation in characteristics among faculty members, the descriptive design can help collect data related to the various characteristics of populations.

Participants

165 Taif University faculty members were randomly selected to fill out an electronic questionnaire. Taif University has been located in the southeast of Saudi Arabia since 2004 and has 16 colleges that offer a wide range of programs for graduate and undergraduate students. The responses were collected from participants with various academic ranks, including lecturers, assistant professors, associate professors, and professors. Also, the faculty members who participated in the current study have different genders and ages. (See Table 1).

TABLE 1
BACKGROUND INFORMATION ON FACULTY MEMBERS

Variables		*N of Participants*	*Percentages %*
Gender	Male	105	63.6
	Female	60	36.4
Age	Less than 34 years	45	27.3
	35-44 years	65	39.4
	45-54 years	25	15.2
	55 years and above	30	18.2
Rank	Professor	40	24.2
	Associate professor	35	21.2
	Assistant professor	50	30.3
	Lecture	40	24.2
Total		165	100

Instrument

An electronic questionnaire was sent to faculty members at Taif University to examine their attitudes toward the use of AR by students with ID. The questionnaire was divided into two parts. The first part collected data about participants' demographics, including their age, gender, and academic ranks. The second part examined their attitudes toward using AR among students with ID. A 5-point Likert scale ranged from (1) strongly disagree to (5) strongly agree. After preparing the questionnaire, ethical approval was obtained from the deanship of scientific research at Taif University to ensure the responses from the participants. The questionnaire also contained a statement requesting the participants' agreement to participate in the questionnaire.

Validity

The study questionnaire was reviewed by five experts who are well-known in disability studies and English translation. The translators recommended some modifications related to the Arabic version of the questionnaire, as two statements were made short. After correcting the recommended modifications, the questionnaire was also exhibited to three experts in disability studies, who confirmed the validity of the questionnaire for distribution. (See Table 2).

TABLE 2
VALIDITY AMONG THE QUESTIONNAIRE'S ITEMS ON FACULTY MEMBERS' ATTITUDES

N	*Items*	*Pearson Correlation*	*(p-value)*
1	I think it is easy for me to use various applications of AR	.693**	.000
2	AR proficiently produce educational resources for students with ID	.433*	.031
3	I feel proficient in the inclusion of educational resources designed by AR in instructing students with ID	.831**	.000
4	teachers need to be trained before using AR with students with ID	.514**	.009
5	AR can be used in classrooms with students with ID	.810**	.000
6	AR can facilitate the education of students with ID	.786**	.000
7	AR reinforces learning and acquisition of key competencies in students with ID	.431*	.031
8	Educational centers have the necessary equipment and infrastructure to implement AR	.755**	.000
9	The AR apps available in AR have a high cost	.571**	.003
10	Tablets and other devices for using AR are expensive	.692**	.000

** (p-value) at (0.01), * (p-value) at (0.05)

Table (2) shows the survey validity using Pearson's correlation coefficients between items of faculty members' attitudes toward using AR among students with ID at Taif University and the total degree of attitude that is statistically significant at the level of significance (0.01) or (0.05). Pearson's correlation coefficients ranged between items with a total score between (0.431* and 0.831**), which was significant at (0.01) and (0.05).

Reliability

The instrument's reliability regarding the faculty members' attitudes toward using AR for students with ID at Taif University was analyzed using Cronbach's alpha on a survey sample consisting of 25 participants. (See Table 3).

TABLE 3
RELIABILITY STATISTICS

The scale	*Cronbach's Alpha*	*N of Items*
Faculty members' attitudes	0.86	10

Data Analysis

The purpose of the present study is to examine faculty attitudes toward the use of AR with students with ID. The current study was quantitatively analyzed using both descriptive and inferential analyses via SPSS 23. The first question was about the faculty members' attitudes toward using AR for students with ID. For this question, the mean and standard deviation of the survey statements were used to identify the faculty members' attitudes. The second question asked about the differences in the responses about faculty members' attitudes toward the use of AR in students with ID attributed to the variables of gender, age, and academic ranks. For this question, a T-test was used to investigate the differences in gender regarding their attitudes toward the use of AR in students with ID; however, a one-way ANOVA was utilized to examine

the differences in ages and academic ranks regarding their attitudes toward the use of AR in students with ID.

RESULTS

The results of this study showed the scores of faculty attitudes toward utilizing AR in students with ID at Taif University. The current study also showed the faculty members' attitudes toward utilizing AR with students with ID according to their gender, age, and academic ranks.

TABLE 4
MEANS AND STANDARD DEVIATION OF FACUTLY ATTITUDES TOWARD USING AR

N	*Items*	*Mean*	*Standard Deviation*	*Scale responses*
1	I think it is easy for me to use various applications of AR	3.79	1.253	Agree
2	AR proficiently produce educational resources for students with ID	4.18	1.089	Agree
3	I feel proficient in the inclusion of educational resources designed by AR in instructing students with ID	3.76	1.159	Agree
4	Instructors need to be trained before using AR with students with ID	4.48	.860	Strongly agree
5	AR can be used in classrooms with students with ID	4.33	.913	Strongly agree
6	AR can facilitate the education of students with ID	4.33	1.038	Strongly agree
7	AR reinforces learning and acquisition of key competencies in students with ID	4.27	1.026	Strongly agree
8	Educational centers have the necessary equipment and infrastructure to implement AR	2.91	1.426	Neutral
9	The AR apps available in AR have a high cost	4.09	.936	Agree
10	Tablets and other devices for using AR are expensive	4.18	.871	Agree
Total		4.03	.773	Agree

Table 4 shows the means and standard deviations of faculty attitudes toward the use of AR in students with ID at Taif University. The results revealed that most faculty members agreed on using AR for students with ID at Taif University. The mean scores of items ranged between M = 2.91 SD = 1.426 and M = 4.48 SD =.860.

In addition, faculty members strongly agreed on some items of the questionnaire, which are "*Instructors need to be trained before using AR with students with ID,*" "*AR can be used in classrooms with students with ID,*" "*AR can facilitate the education of students with ID,*" and "*AR reinforces learning and acquisition of key competencies in students with ID.*" However, they neither agreed nor disagreed that "*educational centers have the necessary equipment and infrastructure to implement AR.*" This would indicate that faculty members at Taif University had generally agreeable attitudes toward using AR for students with ID. Still, they neither agreed nor disagreed that the facilities and centers of Taif University had the essential infrastructure and tools to implement AR for students with ID.

The current study also showed the differences in faculty attitudes toward utilizing AR among students with ID according to gender, age, and academic ranks.

TABLE 5
DIFFERENCES IN FACULTY ATTITUDES TOWARD OF AR BASED ON THEIR GENDER BY USING THE MANN-WHITNEY U TEST

	N	*Gender*	*Mean Rank*	*Sum of Ranks*	*Mann-Whitney U*	*Asymp. Sig. (2-tailed)*
Faculty members' attitudes	105	Male	76.81	8065.00	2500.000	.027
	60	Female	93.83	5630.00		
	165					

The Mann-Whitney U test was processed to examine the means of faculty responses to using AR based on gender. The results reveal statistically significant differences in attitudes toward using AR between male and female faculty members. Female faculty members had a high mean rank (*Md* = 93.83, *n* = 60) compared to male faculty members (*Md* = 93.83, *n* = 105), *U* = 2500.000, *p* =.027. (See Table 5).

TABLE 6
LYSIS OF A ONE-WAY ANOVA REGARDING FACULTY ATTITUDES TOWARD AR BASED ON THEIR AGE

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.476	3	3.159	5.740	.001
Within Groups	88.591	161	.550		
Total	98.067	164			

TABLE 7
SCHEFFE TEST FOR MULTIPLE COMPARISONS AGES

Age (I)	*Age (J)*	***Mean Difference (I-J)***	*Sig.*
Less than 34 years	**45-54 years**	.669	.006
35-44 years	**45-54 years**	.585	012

TABLE 8
ANALYSIS OF A ONE-WAY ANOVA REGARDING FACULTY ATTITUDES TOWARD AR BASED ON THEIR ACADEMIC RANKS

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	24.601	3	8.200	17.971	.000
Within Groups	73.466	161	.456		
Total	98.067	164			

TABLE 9
SCHEFFE TEST FOR MULTIPLE COMPARISONS FOR ACADEMIC RANKINGS

Academic rank (I)	*Academic rank (J)*	***Mean Difference (I-J)***	*Sig.*
Professor	**Associate professor**	.682-	.000
	Assistant professor	.955-	.000
	Lecture	.925-	.000

A one-way ANOVA between-groups analysis of variance was utilized to examine the effect of age on the level of faculty attitudes toward the use of AR in students with ID. Faculty members were divided into four groups based on age (Group 1: Professor; Group 2: Associate Professor; Group 3: Assistant Professor; Group 4: Lecture). There were statistically significant differences at the p.05 level in scores for the four groups: F (3.161) = 17.9, p =.000. The Scheffe Test for multiple comparisons indicated statistically significant differences at the p.05 level between the ages. The mean differences for Group 1 were significantly different from Group 2 (*MD* =.682), Group 3 (*MD* =.955), and Group 4 (*MD* =.925). This would infer that faculty members with lower academic rank reveal agreeable attitudes toward using AR for students with ID. (See tables 6 and 7)

DISCUSSION

The current study investigated the faculty members' attitudes toward using AR for students with ID. It was found that faculty members at Taif University have generally agreeable attitudes toward using AR for students with ID. This result aligns with previous studies that mentioned faculty members are daily hooked on technology, and thus, they have encouraging perceptions of the use of AR for students with ID (Wu, 2022; Sanchez-Diaz & Morgado, 2023). However, the results of the current study showed that faculty members neither agreed nor disagreed that the facilities and centers of Taif University have the essential infrastructure and tools to utilize AR for students with ID. Similarly, Delello (2014) pointed out that the lack of infrastructure in educational centers can hinder teaching through AR apps. Therefore, schools need to make technological reforms to meet the needs of twenty-first-century students (Delello, 2014).

The current study also represented the differences in faculty attitudes toward the use of AR for students with ID in terms of their gender, age, and academic ranks. Firstly, female faculty members had a higher mean rank and intended to have positive attitudes regarding the integration of AR for students with ID compared to male faculty members. This result was opposite to the study of Küçük et al. (2014), who found that the attitude level of male faculty members toward the use of AR was higher than the attitude level of female faculty members. However, Elfeky and Elbyaly (2023) recommended that both male and female faculty members increase their skills related to the employment of AR for students in university education.

Secondly, faculty members with less age tend to have agreeable attitudes toward using AR for students with ID compared to faculty members with more age. Many possible reasons can explain why younger faculty members are willing to use AR for students with ID. It is a fact that the new generation of instructors is frequently exposed to various educational technologies and has experienced their advantages in educational classrooms. Also, younger faculty members can be more flexible in accepting new technological changes in learning and teaching than older faculty members.

Finally, faculty members with less academic rank intend to have agreeable attitudes toward the use of AR for students with ID compared to faculty members with more academic rank. This is a logical result as university education has been integrating technological courses into university curricula and specializations in the last few years. In addition, it can be accurate to say that faculty members who hold less academic rank are more willing to engage in training courses related to AR than those with high academic rank, as they might believe it is not beneficial for their career.

CONCLUSION

To conclude, the current study investigated the faculty members' attitudes toward using AR for students with ID. It was found that faculty members at Taif University had agreeable attitudes toward using AR for students with ID. Still, they neither agreed nor disagreed that the facilities and centers of Taif University have the essential infrastructure and tools to utilize AR for students with ID. Also, older faculty members with high academic rank had disagreeable attitudes about using AR technology for students with ID. Personally, it is important to change the attitudes towards the use of AR among faculty members by holding conferences and symposiums aiming to spread knowledge and awareness of AR, as well as engaging faculty members in training courses related to the employment of AR for students with ID.

RECOMMENDATIONS AND SUGGESTIONS

The current study represented different results that can support the decision-makers responsible for using AR for students with ID in university education. The results above illustrated that many faculty members agree with using AR for students with ID. As a next step, it is recommended to spread the knowledge of AR among faculty members within the university. However, it was found that many faculty members are not completely convinced that the university has the necessary equipment and technological tools in its educational centers. Therefore, it is recommended to rehabilitate all educational facilities and centers of the university with AR technology to promote the inclusion of students with ID.

Moreover, the results also showed that older faculty members with high academic rank have disagreeable attitudes related to the use of AR technology for students with ID. Therefore, it is recommended to engage those faculty members in training programs to increase their awareness about the use of AR and encourage them with praise and incentives.

Many suggestions can be drawn from the current study, which increases the use of AR technology for students with ID. The study mainly focused on faculty members' attitudes without considering the attitudes of college students with ID. Thus, it can be suggested that this study can be replicated to examine the differences in attitudes between faculty members and their students with ID. Also, the current study had few participants from Taif University. Therefore, increasing the number of participants or replicating the current study in various universities in Saudi Arabia is suggested to generalize the results to the faculty members in the whole country.

ACKNOWLEDGMENTS

The author would like to thank faculty members at Taif University for their grateful participation in the current study.

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