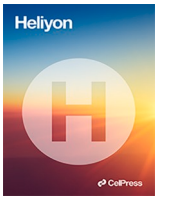
Heliyon 9 (2023) e22736

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Factors influencing the intention of trainee special education teachers to integrate assistive technology into teaching students with disabilities in the United Arab Emirates

Maxwell Peprah Opoku [a,*], Hala Elhoweris [a], Najwa Alhosani [a], Ashraf Mustafa [a], Thara Alkhateri [a], William Nketsia [b]

[a] College of Education, United Arab Emirates University, Al Ain, United Arab Emirates
[b] School of Education, Western Sydney University, Australia

ARTICLE INFO

Keywords:
Assistive technology
Pre-service training
Female teachers
Policymakers
Teachers
United Arab Emirates

ABSTRACT

Technology has been incorporated into the educational systems of many countries as a teaching and learning tool. Contemporary discourse has focused on how to prepare teachers to utilise technology in their teaching practice. Although most pre-service elementary school teachers in the United Arab Emirates are women, studies have not yet investigated their acceptance of or preparedness to use technology in the classroom. Therefore, it is necessary to investigate whether the training provided to pre-service special education teachers equips them with sufficient skills to support students with disabilities. The present study used the technology acceptance model (TAM) as a theoretical lens to examine the factors that impact female pre-service special education teachers' intention to incorporate assistive technology (AT) in teaching students with disabilities. A survey based on TAM was used to collect data from 138 participants and test four study hypotheses. Regarding data analysis, SPSS and AMOS version 28 software were used to conduct exploratory factor, confirmatory factor and path analyses. Two of the four hypotheses were supported. The results provide support for the four-factor TAM structure, with two predictors – perceived ease of use and computer self-efficacy – supporting pre-service teachers' intention to use AT to teach students with disabilities in the classroom. Teacher educators and policymakers should consider the TAM construct when preparing pre-service teachers to effectively support all students. Specifically, teacher development and stakeholder engagement with AT resources are needed to optimise the learning of children with disabilities.

1. Introduction

Assistive technology (AT) is central to advancing learning because it accommodates diverse learning styles in the classroom [1–5]. Advancements in technology, such as the continual development of new tools, software and online learning management systems, have led to discussions on whether teachers are receiving sufficient training in the use of multiple devices in their teaching practice. Studies have shown that special and general education teachers have a low capacity to incorporate technology into their day-to-day

* Corresponding author. Special Education Department, College of Education, United Arab Emirates University, P. O. Box P.O. Box No. 15551, Al Ain, United Arab Emirates.
E-mail address: maxwell.p@uaeu.ac.ae (M.P. Opoku).

https://doi.org/10.1016/j.heliyon.2023.e22736
Received 27 February 2023; Received in revised form 16 November 2023; Accepted 17 November 2023
Available online 24 November 2023

teaching practice [2,4,6,7]. Although some studies have provided nuances [8–10], a negative intersection exists between technology and gender, such that teachers in some societies tend to have less knowledge of technology [11].

In the United Arab Emirates (UAE), most pre-service teachers, especially those trained to teach at elementary school (kindergarten to sixth grade) levels, are female [12–14]. Limited information is available on the AT-related skills taught to pre-service teachers. In UAE, one study highlighted a current emphasis on training a competent local teaching workforce to supplement the skills of expatriate teachers who have been trained elsewhere [15]. This finding only probably supports the exploration of factors that may impact the adoption of AT by female pre-service teachers who are trained to teach students with disabilities in the UAE.

The education of student with disabilities has become a topical issue within the contemporary discourse on creating an equitable society. In this study, disability was conceptually defined as a limitation of activity caused by sensory, physical or cognitive impairments [16]. Such impairments have adverse impacts on individuals' daily lives experiences [16–21]. For example, an impairment can significantly reduce one's ability to participate fully in education [16–18], which has repercussions in terms of one's ability to participate in economic activities and live independently [17,21]. Historically, children with disabilities have been sidelined from all forms of education, deemed uneducable and raised to be dependent on others [2]. However, advocacy [22] on behalf of such children has led to the recognition of the need for education through special schools or inclusion programmes, which have been incorporated into the educational systems of most countries, including the UAE [23–25]. Moreover, there is a consensus among scholars that AT use in the classroom would enhance the learning of students with disabilities.

In the present study, AT refers to a hardware- or software-based technological device that has been specifically developed to help individuals with disabilities compensate for their difficulties, work around their deficits and/or perform day-to-day activities more readily [1–3]. In promoting equitable access to education for all, school systems must make AT accessible to students with disabilities [26]. Although AT use has been recognised as a way to enable participation and enhance the learning of students with disabilities [1,2,26], the role of special education teachers in optimising its operationalisation in the classroom cannot be overemphasised [2,21]. Special education teachers are custodians who promote the learning of children with disabilities in special education and inclusive classrooms [27–29]. Without well-prepared, confident special education teachers [10,30,31], it may be difficult for students with disabilities to benefit from the use of AT in classroom settings.

The realisation of the right to education for children with disabilities has affected teacher development and education [1,3,18–20]. Globally, universities have introduced courses in special education to better equip teachers with the pedagogical skills they need to support all students [32,33]. For example, universities in the UAE have introduced special education programmes to ensure that teachers are qualified to teach students with disabilities in their educational settings [24,34]. Special education teachers are expected to acquire pedagogical skills, develop an awareness of AT and have a sufficient understanding of the concept of disability to support their classroom work. Although some advances have been made in this area [26], gaps remain in practice, as special education teachers appear to struggle to meet the learning needs of students with disabilities [23–25,34]. Since technology is instrumental in contemporary education delivery [1–5], it is useful to expand the literature to include an examination of the perceived skills of pre-service special education teachers in the UAE.

Pre-service special education teachers' readiness to adopt technology in their future classrooms has been underexplored in the UAE and similar contexts. The COVID-19 pandemic has made the relevance of technology more prominent for future teaching and learning [35–37]. In line with contemporary shifts towards educational delivery using technology, the UAE introduced smart technology to expedite teaching and learning [38–41]. Smart technology encompasses the use of advanced technology and pedagogy to teach diverse students, regardless of the environment [40,41]. While the implementation of smart learning is gaining ground in schools in the UAE [42], there has been limited discussion on how special education teachers can implement it for children with disabilities. To provide useful guidelines for teacher educators and policymakers in the UAE, the present study assessed the perceived acceptance of AT by female pre-service special education teachers.

1.1. Theoretical framework: technology acceptance model

A revolution in technology has made it necessary to periodically access the effectiveness of AT. A review of the literature revealed that complex variables have been used to determine the ability of teachers to use AT in their teaching practice and the frequency of that use [1,43–45]. Regarding information communication technology, multiple variables have been shown to impact technology use behaviours in the classroom [43–45]. Furthermore, a variety of models, such as the technology acceptance model (TAM) [46], the unified theory of acceptance model and use of technology [47], the theory of planned behaviour (TPB) [48] and the face-to-face socialisation model [49], have been employed to study teachers' perceptions of technology.

TAM was used in the present study because it was developed to investigate the acceptance or rejection of technology by users [50]. Specifically, TAM, which was created in 1985 by Fred Davis [51], was posited as a lens through which to study the level of acceptance of a given technology. Since its original conception, TAM has undergone two major evolutions. During the inception stage, Davis [51] argued that technology use could be explained by an individual's motivation and the nature of the device or its capabilities.

First, Davis made modifications to TAM after realising how close it was to the theory of reasoned action (TRA). According to Fishbein and Ajzen [52,53], behaviour is the product of normative and behavioural beliefs. While normative beliefs refer to the influence or pressure that significant others place on individuals to behave in certain ways, behavioural beliefs refer to an individual's evaluation of a given activity and their preparedness to perform such behaviour [54]. Normative beliefs relate to subjective norms, while behavioural beliefs develop into attitudes towards a given behaviour [52]. Davis borrowed the concept of the determinant attitude from TRA [55] when developing TAM [56]. Subjective norms were omitted in light of Fishbein and Ajzen's [56] assertion that they were not a strong predictor of intention towards a given behaviour. Davis et al. [46] introduced two core ideas: 1) perceived

usefulness, which refers to the perspective that using a particular technological device could enhance one's performance, and 2) perceived ease of use, which refers to one's perception of the difficulty of operating a given device [50]. The interplay between perceived ease of use, perceived usefulness and attitudes can explain the decision to adopt or continue using a device [57,58].

The second evolution came about as a result of a study [59] that revealed the minimal effect of attitude on the use of a technological device. Davis et al. [46] postulated that the perceived usefulness and ease of use of a device could directly predict behavioural intentions. This finding was supported by later research [60], and it paved the way for the testing of a second version of the model by other scholars [57,58,60] and the extension of TAM [58]. For example, Venkatesh and Davis [61] proposed TAM 2, which outlined six additional background variables: computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment and objective usability. These variables were all used in the model to predict technological intention. This only seems to suggest that scholars could revise TAM and assess its predictive utility for a given population.

Nam et al. applied modified versions of TAM in a recent study of special education teachers' ability to use AT to teach students with sensory disabilities in the United States [50]. The authors reviewed the literature on the perception of instruction of students with sensory impairments and identified variables for inclusion in TAM. They kept perceived usefulness and perceived ease of use and added three variables: facilitating condition, demonstrability of results and computer self-efficacy [50]. Facilitating condition refer to teachers' beliefs that the school where they wish to teach has the necessary infrastructure to support AT use in their teaching practice [50]. Demonstrability of results refers to the belief that teachers can use AT to enhance the learning of their students, and computer self-efficacy refers to teachers' confidence in their ability to use AT to support student learning [50].

These variables were adapted for the present study, which, to the best of our knowledge, is the first study to utilise TAM to understand teachers' perceptions regarding using AT to instruct students with disabilities. However, since TAM took inspiration from Ajzen [52] in relation to the concept of TPB, the present study proposes a new model for use in the UAE context (see Fig. 1). For example, in the present study, we argued that all independent variables would be combined to predict the intention to use AT in the classroom (see Fig. 1 and Hypotheses I and II). This could provide the basis for a clear assessment of the variables that may have a direct impact on the intentions of female pre-service teachers in the UAE.

The literature on education and teaching students with disabilities has identified several barriers that appear to be related to the components of the revised model [16–21]. The UAE government is searching for best practices that could influence actual teaching practices for all children, including those with disabilities [62]. Unfortunately, this has not been the primary focus of previous research [12,63], which did not comprehensively validate TAM or propose a useful guide to curriculum development or teaching practices. Studies on the validity and reliability of TAM are rare. In the UAE context, TAM has been used to study the perceptions of teachers [12],

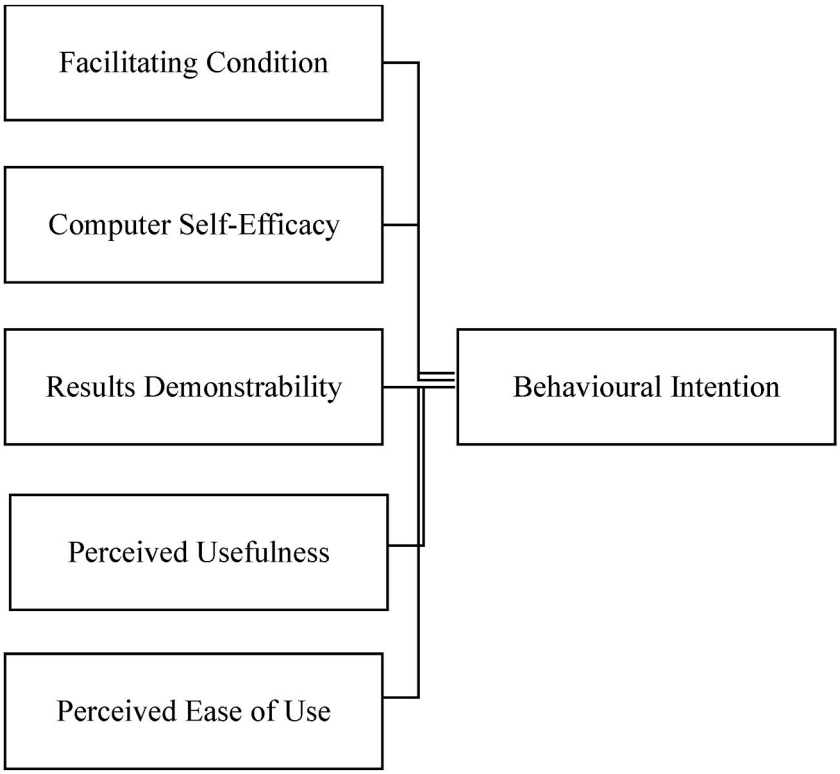


Fig. 1. Proposed technology acceptance model for UAE.Note: Example of items connected to framework: Behavioural Intention [Assuming I have access to technology, I intend to use it to teach]; Computer self-efficacy [The results of using the technology are apparent to me]; Perceived ease of use [Learning to operate the technology would be easy for me]; Perceived usefulness [I would find the technology easy to use].

including special education teachers [63], on technological competencies in general without narrowing the focus to establish the degree to which pre-service special education teachers embrace AT to instruct students with disabilities. Thus, it is necessary to assess whether the variables proposed by Nam et al. [50] could be combined with existing components of TAM to predict female pre-service special education teachers' perceptions of using AT.

In the present study, we developed the following hypotheses.

Hypothesis I. TAM has structural validity in the UAE context.

Hypothesis II. Independent variables combine to predict female pre-service special education teachers' intentions to use AT in the UAE.

1.2. Previous studies on teachers and AT

Very few studies have assessed pre-service special education teachers' preparedness to adopt AT in their future classrooms. However, studies on general education teachers, AT and the acceptance of technology provide a useful framework to examine this topic in the context of pre-service special education teachers. Teachers in many countries have acknowledged the importance of AT in promoting the learning of students with disabilities [10,64,65], culminating in discussions on the training and preparation that teachers require before they can use AT in the classroom.

Although progress has been made in the development of teacher training institution courses that prepare teachers to teach diverse students [4,65–70], pre- and in-service teachers continue to encounter barriers to the use of AT [43]. In the present study, the challenges were broadly categorised as teacher-, school- or governmental policy-level challenges [43,44,71,72]. At the teacher level, studies have investigated teachers' beliefs, knowledge, abilities and perceptions regarding the usefulness of AT [6,43,44,65,66,70, 73–78]. A large body of literature has reported that teachers have low levels of confidence [70,71,77] and knowledge [6,64,70,74,79, 80] regarding the application of technology to support students with disabilities. Teachers have reported that their inability to use technology in the classroom is due to a lack of professional development [4,74,80,81] or inadequate pre-service training [64,74,76]. These findings have implications for teacher development in countries such as the UAE, where teacher educators need to be mindful of the quality of the training given to pre-service teachers.

External factors can impact the ability of teachers to use AT in the classroom [6,43,44,70,72,80]. At the school level, factors such as time and the unavailability of AT products could deny teachers the opportunity to implement AT in the classroom [78]. Moreover, other developments, such as lack of time [45] and large class sizes, have contributed to a reduction in the amount of time teachers have to apply AT in the classroom [73]. In some schools, few experts are available to train or provide technical support to teachers [80]. As such, teachers may be constrained and unable to help students with disabilities learn how to use AT. Additionally, teachers are sometimes hampered by a lack of supportive policies or the inability of the educational system to supply the required AT to schools [6].

Thus, some teachers are open to using technology to teach students with disabilities but face school- and policy-level constraints that limit their ability to do so. According to Ajzen [52,53], this development has adverse effects on teachers' self-efficacy and ability to perform their duties. Specifically, poor environmental support can reduce teachers' use of AT to support the learning of students with disabilities. In the UAE context, the development of a more favourable school and policy environment may be necessary to enable teachers to use AT in the classroom. Unfortunately, there is limited information on whether pre-service special education teachers are prepared to use AT to teach students with disabilities in their future classrooms.

Ajzen [52] has argued that researchers should pay attention to the antecedents of behaviours by using background variables to gain additional insight into a given phenomenon. Some studies on teachers and AT have focused on background variables that may influence teaching practices [7,10,45,54,66,68–70,74,82]. However, in those studies, the background variables were found to be fluid, which could impact pre- and in-service teachers' perceptions and beliefs regarding the use of AT. While some studies have found that AT training impacts teachers' beliefs, others have reported that it does not [75]. Still other studies have found no relationship between teachers' beliefs and perceived practices [3,54,69,73]. Prestridge [45] noted a relationship between attitudes and teaching practices. Also, findings have been reported regarding the differences between teachers in terms of age, confidence and teacher type [45,54,66, 75]. Amidst the limited literature on special education and AT in the UAE, the fluidity of the findings of previous studies underscores the need for further research in the current study context, where the discussion of the importance of AT to teaching is in its embryonic stages.

1.3. Contextualisation

The UAE has an estimated population of nearly 10 million people and an economy that relies on oil extraction and the service sector. The government has placed human development on its agenda and developed a range of policies to advance the lives of its citizens [14,62]. Unfortunately, the perception of disabilities in the UAE is driven by notions that are not supported by science [23–25, 34,83]. These erroneous ideas drive perceptions that have had adverse effects on the lives of people with disabilities, who are referred to in the UAE as people with determination [23]. The UAE government is a signatory to the Convention on the Rights of Persons with Disabilities, and it has passed laws and policies to advance the lives of people with disabilities. For example, Federal Law No. (29) of 2006, amended in Federal Law No. (2) of 2014, was a key legal milestone guiding service provisions for people with disabilities [34].

Nonetheless, people with disabilities still lag behind those without disabilities on every development index in the UAE [23–25,34]. Consequently, the government has included vulnerable groups, such as people with disabilities, at the heart of its development agenda for the next 50 years. As part of this effort, engagement between policymakers and academics has increased in terms of the preparation

of relevant professionals, such as teachers, to teach students with disabilities. For example, public universities offer degree programmes in special education to prepare teachers to teach all students. Nevertheless, research has shown that teachers struggle to offer appropriate teaching services to students with disabilities in the classroom [23–25,83]. Unfortunately, empirical study of pre-service special education teachers' perceptions of using AT to teach students with disabilities has received little attention in the literature. In light of the inadequate training of teachers related to the teaching of students with disabilities [24,34], we proposed the following hypothesis.

Hypothesis III. AT training could have a limited influence on female pre-service teachers' intentions to use AT to teach students with disabilities in their future classrooms.

It is important to note that the COVID-19 pandemic has impacted the teaching and learning of students with disabilities in schools. In the UAE, students with disabilities who are enrolled in special education or inclusive schools continue to receive online education. Pre-service teacher education is currently hybrid in nature, consisting of face-to-face and online classes. However, in the AT literature, the influence of pre-service special education teachers' learning preferences on their perceptions of using AT to teach students with disabilities has not yet been determined. In the present study, we argued that pre-service teachers with a preference for online learning may be open to using AT to teach students with disabilities. Thus, we proposed the following hypothesis.

Hypothesis IV. Pre-service special education teachers' online learning preferences impact their motivation and intention to use AT to teach students with disabilities.

To provide baseline information to policymakers, the present study tested the structural validity of TAM in the UAE. The aims of the study were to validate the hypotheses and answer the following research questions.

1. Is the structure of TAM valid in the UAE context?
2. What are the predictors of female pre-service special education teachers' intention to adopt AT to teach students with disabilities in the UAE?
3. Do female pre-service special education teachers' AT training and learning preferences influence the relationship between predictors and their intention to adopt AT to teach students with disabilities in the UAE?

2. Methods

The present study employed a cross-sectional design whose purpose was to capture, at a given time [84], the preparedness of female pre-service special education teachers to use AT in the classroom.

2.1. Study participants

The study participants were drawn from a cohort of 160 female students enrolled in a special education degree programme at United Arab Emirates University in the UAE. The study setting was suitable because the university is nationally recognised as a centre of excellence for the training of special education teachers in the UAE. Due to its reputation, students from across the country compete to gain admission to this university. Therefore, the student body is heterogeneous and represents the diversity of the country.

A total of 138 female pre-service special education teachers were recruited for this study. Of these, 43 % were between the ages of

Table 1
Summary of association between demographics and variables.

$N = 138$	Sample (%)
Age	
18–21 years	59 (43 %)
22–25 years	50 (36 %)
At least 26 years	29 (21 %)
Future environment	
Special school	80 (58 %)
Inclusive school	58 (42 %)
Year of study	
First year	16 (12 %)
Second year	23 (17 %)
Third year	53 (38 %)
Fourth year	46 (33 %)
Training in AT	
Yes	118 (86 %)
No	20 (14 %)
Learning preference	
Face-to-face	96 (70 %)
Online learning	42 (30 %)

AT = Assistive technology.

18 and 21 and 21 % were older than 26; 12 % and 33 % were in their first and final years of study, respectively. Furthermore, 58 % stated that they hoped to teach in a special school, while 42 % indicated a preference for teaching in an inclusive school. Although 86 % had taken one or more courses in AT, 30 % preferred online learning (see Table 1).

2.2. Instrument

A two-part instrument was used to collect the data. The first part gathered information on the demographic profiles of the participants, including age, year of study, future teaching environment, AT training and learning preference (see Appendix).

The second part of the instrument was developed based on Nam et al.'s [50] adaptation F The questionnaire consisted of 27 items identifying six factors (facilitating condition, computer self-efficacy, demonstrability of results, perceived usefulness, perceived ease of use and behavioural intention) on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree) (see Appendix). The first factor, perceived usefulness, consisted of three items, including 'The performance of my students with disabilities is improved by using the technology' and 'Using the technology enhances my effectiveness in my job'.

The second factor, perceived ease of use, consisted of four items, including 'Learning to operate the technology would be easy for me' and 'I would find it easy to get the technology to do what I want it to do'. The third section, facilitating condition, consisted of four items, including 'I have the resources necessary to use the technology' and 'I have the knowledge necessary to use the technology' (see Appendix for details).

The Delphi method, which involves subjecting a questionnaire to an expert review before data collection, was applied to ensure that the instrument collected appropriate, relevant information [85]. Two experts in the field of special education commented on the appropriateness of the questionnaire for data collection in the UAE.

2.3. Procedure

The study was approved by the Social Sciences Ethics Committee at United Arab Emirates University (ERS_2021_8417). The fourth and fifth authors sent the information statement to students to collect the data. Since most students were studying remotely due to the COVID-19 pandemic, Google Forms was used for data collection. An informational statement about the study was sent to all students enrolled in the special education programme. The information statement was sent several times before the final questionnaire link was sent to the students. English and Arabic versions of the questionnaire were provided to ensure comprehensibility. Clicking on the link was taken as informed consent to participate in the study. The participants were assured that their participation would be anonymous and that their identities and any information about their responses would not be disclosed to anyone outside the research team. The data were collected between August 2021 and October 2021. On average, it took the students about 20 min to complete the questionnaire.

2.4. Data analysis

The collected data were transferred to Microsoft Excel for cleaning and analysed using Statistical Package for Social Science and AMOS version 28 software. Missing data were assessed using Little's missing completely at random test. Since less than 5 % of the data was missing, we used the expectation–maximisation algorithm to input the missing data [86]. The normality of the data was assessed to ensure that it met the basic standards for the parametric test. The histograms showed that most of the scores for the continuous variables were in the middle ranges, suggesting that the data were reasonably normally distributed [86].

Research questions 1 and 2 were assessed using exploratory factor analysis (EFA) and structural equation modelling. For research question 1, confirmatory factor analysis (CFA) was also used. This approach was in line with Worthington and Whittaker's argument that EFA and CFA are both appropriate for validating a given tool [86]. SPSS software was used to conduct the EFA. The validity of the tool was checked using the Kaiser-Meyer-Olkin test, which had a cut-off value of 0.6, as well as Bartlett's test of sphericity. The Harman single-factor test showed a score of 48 %, suggesting no common method bias. The acceptable loadings for the items were set at 0.30 [86].

After EFA, the data were transferred to AMOS version 28 software to address the research questions. CFA was conducted to assess the structural validity of TAM in the UAE context. Latent variables were observed for the predictors, and outcome variables were also observed. Regression weighting of 0.50, correlation and covariance were also computed. The correlations between the sub-scales were checked and interpreted for research question 1 as follows: small was below 0.30, medium was between 0.30 and 0.49 and large was at least 0.50 [86]. The goodness of fit of the model was assessed using the following thresholds: chi-squared <5, Tucker–Lewis index (TLI) ≥ 0.09, comparative fit index (CFI) ≥ 0.90, root mean square error of approximation (RMSEA) ≤ 0.08 and standardised root means square residual (SRMR) ≤ 0.08 [87,88]. In the event that three thresholds were met, the model was considered satisfactory.

To determine the reliability of the data, convergent and discriminant validity tests were conducted. The following thresholds were used for convergent validity: a standardised regression weight of at least 0.50, composite reliability of at least 0.7 and average variance extracted of at least 0.50. The indicators, including the square roots of average variance, the average variance extracted and the estimated correlation coefficient between the latent variables, were compared to examine discriminant validity.

To answer research question 2 and understand the predictors of intention, a path analysis was performed. The aforementioned fit indices were used to assess the validity of the model that emerged from the path analysis.

To address research question 3, a direct path analysis was conducted. Demographic variables (learning preferences and AT training) were used as moderators [86] to understand their influence on the relationship between the independent and dependent

variables (intention).

3. Results

3.1. Scale reliability and validity

EFA was conducted to assess the validity of the 27-item TAM scale developed by Nam et al. [50]. Initial inspection showed that most of the inter-item correlation coefficients were at least 0.30. The Kaiser-Meyer-Olkin test result was 0.89, and Bartlett's test of sphericity indicated significance ($p = .001$; see Table 2).

The initial results showed that six items had eigenvalues of at least 1. However, an inspection of the screen plot revealed four clear breaks. Thus, another EFA was run with the factor structure fixed at 4. The results showed eigenvalues of 12 %, 2 %, 1 % and 1 % and all contributed 65 % of the variance. The Oblimin rotation showed that all 27 items were loaded on the following four factors: Factor I (behavioural intention = 6 items), Factor II (perceived ease of use = 4 items), Factor III (computer self-efficacy = 10 items) and Factor IV (perceived usefulness = 7 items).

A three-model CFA was computed to determine the structural validity of the scale (see Table 3). In the first model, two items had factor loadings of less than 0.50; they were deleted to improve the fit indices. A second model was run in which only one item had a factor loading below 0.50.

The third model showed an acceptable fit index, and the remaining 24 items had the following near the thresholds: chi-squared = 3.38, CFI = 0.93, TLI = 0.90, RMSEA = 0.09 and SRSMR = 0.06 (see Fig. 2). The items were distributed as follows: Factor I (behavioural intention = six items), Factor II (perceived ease of use = four items), Factor III (computer self-efficacy = nine items) and Factor IV (perceived usefulness = five items).

Next, the reliability of the model was assessed using convergent and discriminant tests of validity. Factor loadings were measured using regression weights, composite reliability and average variance extracted. All items were measured using regression weight and had factor loadings above 0.50. The average variance extracted was above 0.50, and the composite reliability was above 0.70 (see Table 4).

To evaluate discriminant reliability, the correlation coefficients and the square roots of the average variance extracted were compared (see Table 4). It was expected that the square roots of the average variance extracted would be higher than the correlation coefficients. The results showed that most of the square roots of the average variance extracted were higher than the correlation coefficients of the scale.

A reliability test conducted using Cronbach's alpha yielded the following scores: usefulness = 0.80, ease of use = 0.80, efficacy = 0.90 and intention = 0.95. The overall model yielded a reliability score of 0.95.

Table 2
Summary of exploratory factor analysis.

	Factor I	Factor II	Factor III	Factor IV
A1				.33
B2		.66		
C3				.43
D4		.75		
E5		.69		
F6		.78		
G7				.31
H8			.44	
I9				.36
J10				.49
K11			.62	
L12				.32
M13			.54	
N14			.42	
O15				.79
P16			.74	
Q17			.62	
R18			.66	
S19			.47	
T20			.55	
U21			.39	
V22	.81			
W23	.82			
X24	.83			
Y25	.79			
Z26	.86			
AA27	.78			

Factor I = Behaviour intention; Factor II = Perceived ease of use; Factor III = Computer self-efficacy; Factor IV = Perceived usefulness.

Table 3
Summary of model fit indices.

	df	χ2	CFI	TLI	RMSEA	RSMR
Model 1	318	3.25	.74	.70	.13	.63
Model 2	269	3.31	.77	.72	.13	.71
Model 3	246	3.38	.93	.90	.09	.06
Model 4	269	3.96	.90	.88	.08	.07
Model 5	269	4.00	.90	.87	.08	.07

df = degree of freedom; χ2 = chi-square; Comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), standard root means square residual (SRMR).

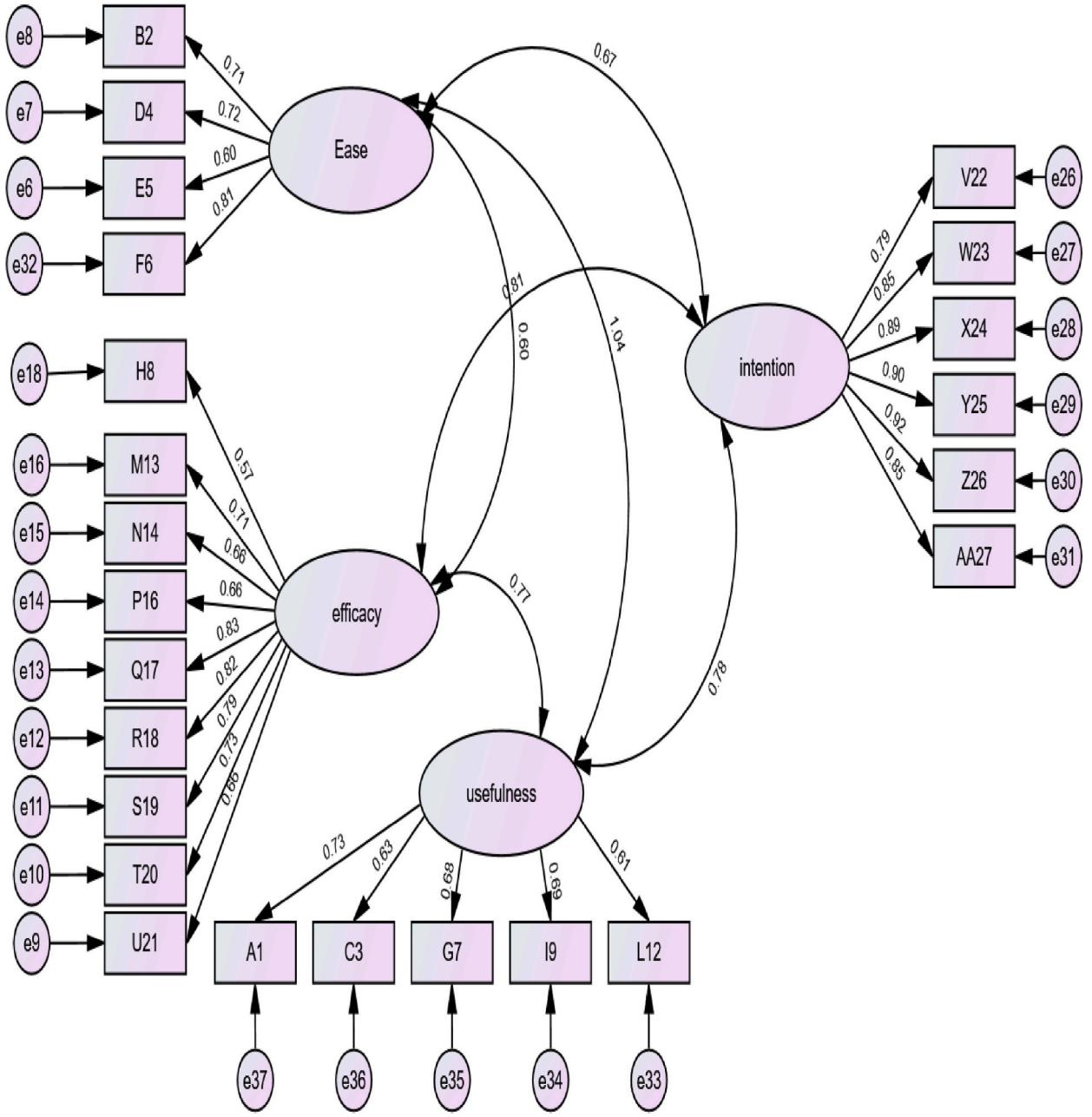


Fig. 2. Summary of the CFA results.Ease = perceived ease of use; usefulness = perceived usefulness; efficacy = computer self-efficacy; intention = behavioural intention.

Table 4
Summary of convergence and discriminant validity tests.

Codes	Factor loadings	CR	AVE	Usefulness	Ease	Efficacy	Intention
A1	.73	.80	.67	.82##			
C3	.63						
G7	.68						
19	.69						
L12	.61						
B2	.71	.91	.71	1.04#	.84##		
D4	.72						
E5	.60						
F6	.81						
H8	.57	.81	.71	.77#	.61#	.84##	
M13	.71						
N14	.66						
P16	.66						
Q17	.83						
R18	.82						
S19	.79						
T20	.73						
U21	.66						
V22	.79	.95	.87	.78#	.67#	.81#	.93##
W23	.85						
X24	.89						
Y25	.91						
Z26	.92						
AA27	.85						

CR = Composite reliability; AVE = Average variance extracted; # = Correlation coefficient; ## = Square roots of average variance; Ease = perceived ease of use; usefulness = perceived usefulness; efficacy = computer self-efficacy; intention = behavioural intention.

3.2. Relationship between the tenets of TAM

There was a high correlation between the sub-scales, as evident in the results for behaviour intention and perceived usefulness ($r = .78$), behaviour intention and perceived ease of use ($r = 0.67$), behaviour intention and computer self-efficacy ($r = 0.81$), perceived usefulness and perceived ease of use ($r = 1.04$), perceived usefulness and computer self-efficacy ($r = 0.77$) and computer self-efficacy

Table 5
Summary of mean scores.

Code	Item	M (SD)
	Perceived usefulness	4.15 (.60)
A1	The performance of my students with disabilities is (would) improve by using the technology.	4.04 (.98)
C3	Using the technology would enhance my effectiveness in my job	4.36 (.67)
G7	I would find the technology easy to use.	4.26 (.89)
I9	I have the knowledge necessary to use the technology	4.04 (.80)
L12	I would have no difficulty telling others about the results of using the technology	4.05 (.87)
	Perceived ease of use	4.11 (.64)
B2	The productivity of my students with disabilities is (would) improve by using the technology.	4.07 (.83)
D4	Learning to operate the technology would be easy for me.	4.19 (.85)
E5	I would find it easy to get the technology to do what I want it to do.	4.01 (.80)
F6	It would be easy for me to become skillful at using the technology	4.16 (.74)
	Computer self-efficacy	4.06 (.58)
H8	I would have the resources necessary to use the technology	3.99 (.77)
M13	I believe I could communicate to others the consequences of using the technology.	4.01 (.84)
N14	The results of using the technology are apparent to me	4.00 (.76)
P16	I could complete a task using a computer if I had seen someone else using it before trying it myself.	3.92 (.76)
Q17	I could complete a task using a computer if I could call someone for help if I got stuck	4.15 (.65)
R18	I could complete a task using a computer if someone else had helped me get started.	4.05 (.79)
S19	I could complete a task using a computer if I had a lot of time to complete the task.	4.13 (.78)
T20	I could complete a task using a computer if someone showed me how to do it first.	4.09 (.85)
U21	I could complete a task using a computer if I had used a similar software before to do the same job.	4.20 (.75)
	Behavioral intention	4.17 (.74)
V22	Assuming I have access to technology, I intend to use it to teach.	4.15 (.85)
W23	Assuming I have technology in class, I intend to use it support the learning of all students	4.06 (.89)
X24	Assuming I have access to technology, I intend to use to enhance the class participation of student with disabilities	4.17 (.75)
Y25	Assuming I have access to technology, I intend to use to help students demonstrate their learning	4.22 (.80)
Z26	Assuming I have access to technology, I intend to encourage other teachers to use it	4.24 (.82)
AA27	Assuming I have access to technology, I intend to encourage parents to use it at home to support students' learning	4.15 (.89)

M = Mean; SD = Standard deviation.

and perceived ease of use ($r = 0.61$).

3.3. Level of perceived acceptance

The computation of the mean indicated the level of perceived acceptance regarding perceived usefulness ($M = 4.15$; $SD = 0.60$), ease ($M = 4.11$; $SD = 0.64$), efficacy ($M = 4.06$; $SD = 0.58$) and intention ($M = 4.17$; $SD = 0.74$) (see Table 5).

3.4. Path analysis

A path analysis was conducted to identify whether the contribution of the independent variables was significant for the variance in intention. The model yielded appropriate fit indices (as in Model 4). The overall contribution of the independent variables to the variance in intention was 13 % ($p = .001$). However, individually, only computer self-efficacy made a significant contribution to the variance in intention ($b = 0.62$, $p = .001$). Thus, neither perceived usefulness ($b = 0.07$, $p = .25$) nor perceived ease of use ($b = 0.23$, $p = .36$) made any significant contribution to the variance in intention. The results revealed covariance and a high correlation between the independent variables (see Fig. 3).

3.5. Learning preference and its impact on intention

The learning preference of the participants was used as a moderator to identify the influence of preference on the independent variables (perceived usefulness, computer self-efficacy and perceived ease of use) and the outcome variable (intention). Please see the Model 4 results in Table 3 for the fit indices.

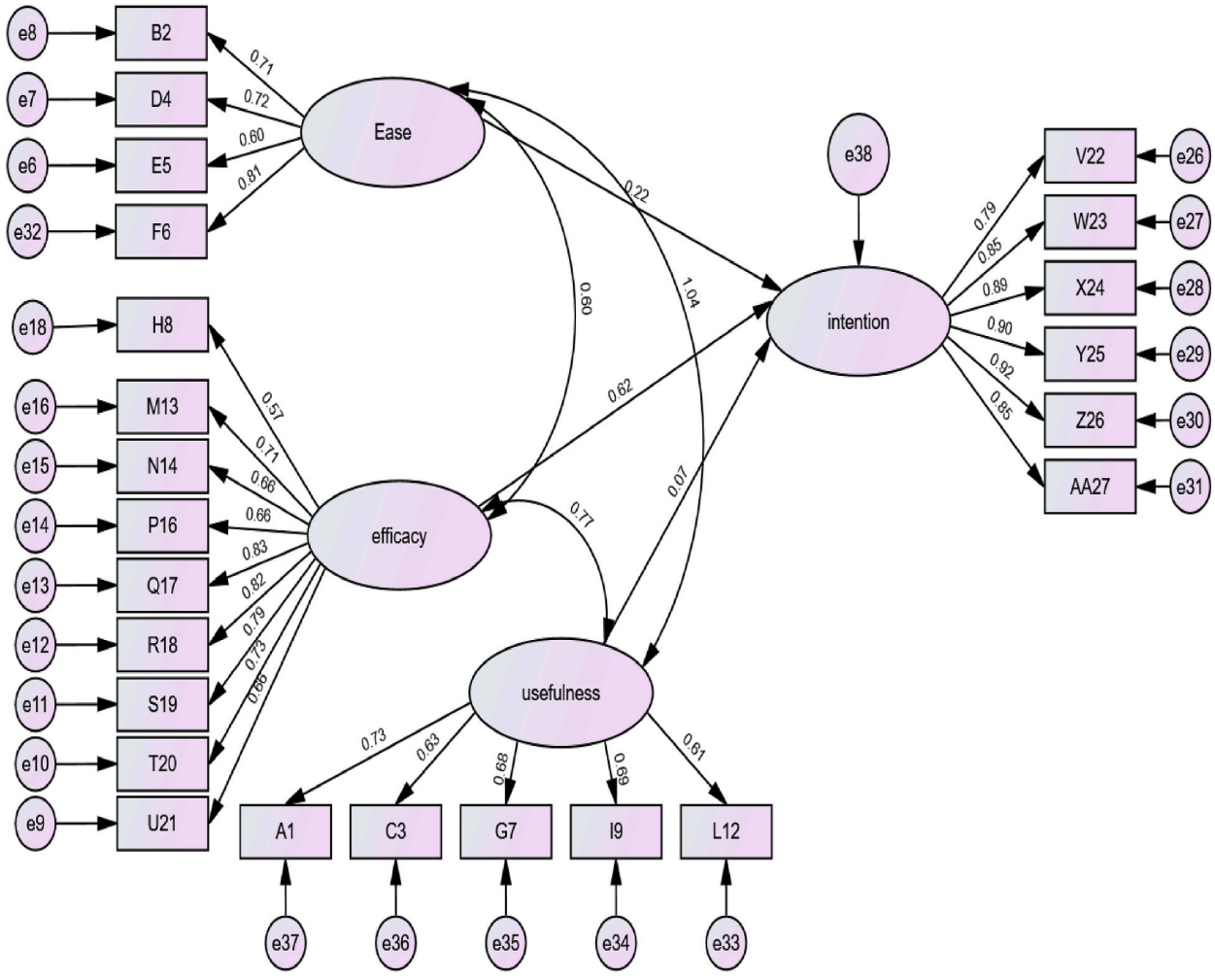


Fig. 3. Summary of the path analysis.*Ease = perceived ease of use; usefulness = perceived usefulness; efficacy = computer self-efficacy; intention = behavioural intention.*

Perceived ease of use ($b = 0.05$, $p = .02$) and computer self-efficacy (b = 0.56, $p = .001$) each had a direct influence on intention, while perceived usefulness (b = −0.21, $p = .63$) did not. After adding the pre-service female teachers' learning preference to the model, the indirect influence was not significant for perceived usefulness (b = −0.02, $p = .60$), perceived ease of use (b = −0.04, $p = .50$) or computer self-efficacy (b = −0.05, $p = .61$). It is important to note that learning preference only had a direct influence on computer self-efficacy (b = 0.05, $p = .05$).

The influence of AT training on the relationship between the independent variables and intention was also assessed (see the Model 5 results in Table 3 for the fit indices). Once again, while computer self-efficacy ($b = 0.55$, $p = .001$) and perceived ease of use ($b = 0.07$, $p = .02$) each had a direct influence on intention, the addition of AT training did not have a significant influence on computer self-efficacy ($b = -0.05$, $p = .32$) or perceived ease of use ($b = -0.08$, $p = .37$). However, AT training had a direct influence on perceived ease of use ($b = -0.55$, $p = .05$).

4. Discussion

The validity and reliability of TAM were tested to identify its structural validity in the UAE context. For the version of TAM adopted in this study, five independent variables were combined to predict female pre-service teachers' intention to use AT to teach. Hypothesis I was supported by the EFA and CFA results, which showed that three independent variables (perceived usefulness, computer self-efficacy and perceived ease of use) could be combined to predict pre-service teachers' intentions in the UAE context. This conclusion is partially in agreement with previous research on the structural validity of TAM in the study of teachers' acceptance of technology [50,60].

It is important to note that special education teachers in the UAE and similar contexts struggle to teach students with disabilities in the classroom [23–25,34]. Thus, to promote the use of AT to enhance the learning of students with disabilities, pre-service teachers need to understand the usefulness of AT devices, recognise their ease of use and build their confidence in applying them in the classroom. In the UAE, many teachers who specialise in elementary education, including the participants in this study, are very reserved and may seek to work independently without depending on others; this is especially likely among those who are more comfortable using technology. Once teacher training institutions prioritises or develop more courses in the usage of AT for teaching, teachers will regard technology more positively and be more willing to use it in the classroom. Anecdotal evidence suggests that the UAE has sufficient financial and teaching resources to support schools; the missing link appears to be an inability to demonstrate the relevance of AT and its application in the classroom.

Although the structure of TAM was found to be valid and reliable in the UAE context, only two predictors—perceived ease of use and computer self-efficacy—made significant contributions to the variance in behavioural intention. Hypothesis II was supported by study findings that revealed that there is widespread apprehension in society regarding the instruction of students with disabilities and that most schools and special education teachers struggle to support the learning of such students [25,34]. Certainly, the introduction of AT into the education of children with disabilities can enable teachers to use such devices to ease or facilitate teaching activities in the classroom [1,60]. In the UAE context, policymakers could consider purchasing AT devices that are easy for teachers to use in the classroom, since some complicated devices might be difficult to adopt. Meanwhile, the findings underscored the need to pay greater attention to developing teachers' self-confidence in training. Training courses that instruct teachers on the use of AT to teach children with disabilities should include elements that explain AT approaches and operations as well as build the teachers' confidence. To adequately prepare pre-service teachers and enhance their education, teacher training institutions could consider providing hands-on training on usage of AT to pre-service teachers. Such real classroom experiences could impact teachers' self-efficacy in utilising AT devices for teaching.

Meanwhile, the high positive correlation found between the predictors strongly reinforces the proposition that a combination of teacher, school and governmental policy-related initiatives may be needed to support teachers' use AT to teach students. The findings of this study are in partial agreement with those of previous studies that indicated a need to create a multifaceted environment before enabling teachers to use AT to teach all students in the classroom [1,43–45].

In the UAE context, women have the primary responsibility for raising children and taking care of the home as well as their job responsibilities. This situation underscores the need for supplemental support for female pre-service special education teachers to enable them to effectively implement AT in the classroom. In the current environment, it is important to enhance the learning of students with disabilities in classroom settings. For example, teachers need additional skills and a supportive school and policy environment before they can facilitate the learning of students with disabilities [43,44]. Interdependence between these variables is needed before teachers can adopt AT to assist them. For instance, teachers need to be educated about the usefulness of the available AT and its ease of use and encouraged to develop their self-efficacy before they can implement this technology in the classroom. This suggests that students with disabilities might not be provided with the support they need if a certain condition is unmet. This finding provides evidence of the need for teacher educators and policymakers in the UAE to consider teacher training as well as the creation of an environment that supports the use of AT to teach students with disabilities in the classroom.

While most of the predictors were interdependent, perceived usefulness had no impact on the intention of pre-service teachers to use AT to teach children with disabilities. Due to their extensive responsibilities, female teachers may attempt to engage in activities that they find relevant and appropriate. The study findings suggest that female pre-service teachers may be unaware of or sceptical about whether appropriate measures have been implemented to facilitate the integration of AT into their teaching practice. This finding is surprising, as many studies have reported the complete inability of teachers to use AT to teach [6,64,70,74,79,80]. To ensure that the appropriate measures are in place, policymakers must make sure that the resources and robust supportive measures required to complement teachers' efforts are available in schools. Based on the results, it is apparent that pre-service teachers receive some form of

AT training; however, policies should be updated to ensure that teachers receive the services they need. Stakeholders such as teachers, policymakers and teacher educators must deliberate on the context-specific technological environment required in schools.

The study findings did not support Hypothesis III or Hypothesis IV. The participants' learning preferences and AT training did not influence their intention to use AT to teach students with disabilities. It is important to note that the learning preferences of female pre-service special education teachers may not ultimately affect their teaching practice. However, the quality of the training provided to them may matter. Some studies have argued in favour of AT courses that prepare pre-service teachers to embrace the use of AT in their future teaching practice [6,74]. The present study may reinforce the belief that the learning preferences of teachers do not matter. Moreover, the lack of influence of AT training on the relationship between independent variables and intention revealed some issues regarding the quality of the training being provided to female teachers in the UAE. As previously mentioned, many studies have noted that teacher training has not sufficiently prepared teachers to apply AT in the classroom [64,74,76]. The present study underscores the need to pay attention to the quality of training provided to pre-service teachers in the UAE.

4.1. Study limitations

The results of this study cannot be generalised widely due to several study limitations. First, the study relied on the self-reporting of female pre-service special education teachers and did not include in-service teachers, which would have provided a broader view of the topic. Nonetheless, this study is the first of its kind in the UAE context, and it provides a useful basis for future studies. Second, the study only gathered data on the predictors of female pre-service special education teachers' intentions; it did not delve into actual teaching behaviours. While Ajzen [52,53] hypothesised the existence of a relationship between intention and actual teaching behaviours, future studies should explore this relationship in the UAE context. Third, the study utilised quantitative methods that did not give the participants the opportunity to provide the reasoning underpinning the reported findings. It is recommended that future studies use a mixed-methods design to develop deeper insights into the perceptions and actual teaching practices of in-service special education teachers regarding the use of AT to teach children with disabilities. Nevertheless, this study assessed the utility of a model tested in Western societies for a non-Western context (the UAE), where the education of children with disabilities is in development.

5. Conclusion and implications

The present study investigated female pre-service special education teachers' perceptions of using AT to teach students with disabilities in the UAE. This study is the first to attempt to understand female pre-service teachers' perceptions of using AT to teach students with disabilities. TAM [51,46], which was developed and is widely used in Western societies to study the acceptance of technology, was used as the study lens. Two of the four hypotheses were supported by the findings. The study can serve as a resource for a four-component TAM structure, and the results showed that two of the components of TAM could influence or explain pre-service teachers' intentions regarding using AT to teach students with disabilities. Moreover, a link was found between the predictors, suggesting their relevance in the UAE context. Unfortunately, neither AT training nor future teachers' learning preferences were found to influence pre-service teachers' intention to use AT to teach students with disabilities.

The discussion of the use of AT is in its early stages in the UAE, and the findings of this study could provide policymakers with useful policy guidelines. It also provides recommendations to policymakers and teacher educators regarding what needs to be done in the UAE to promote the use of AT to teach children with disabilities. The results regarding computer self-efficacy and perceived ease of use underscore the need for teacher educators and policymakers to pay attention to these factors. This could be achieved by providing training on various AT devices and exploring ways to increase pre-service teachers' confidence and expose them to more hands-on training in the operation of AT devices. Moreover, stakeholder engagement could be increased among teachers, teacher educators and policymakers in terms of the technology and environment needed to integrate AT into the teaching process. Discussions on these topics could contribute to the design of an acceptable framework for teacher training and support the adoption of AT in teaching practice. Additional scholarly research on AT is necessary to explore and develop a UAE model for teacher training that places emphasis on the importance of using AT in the classroom, which could guarantee that all students with disabilities obtain meaningful access to quality education.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available due to ethical restrictions but are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Maxwell Peprah Opoku: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Writing - original draft, Writing - review & editing. **Hala Elhoweris:** Conceptualization, Investigation, Methodology, Writing - original draft, Writing - review & editing. **Najwa Alhosani:** Conceptualization, Investigation, Methodology, Writing - original draft, Writing - review & editing. **Ashraf Mustafa:** Conceptualization, Investigation, Methodology, Supervision, Validation, Writing - original draft, Writing - review & editing. **Thara Alkhateri:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing - original draft, Writing - review & editing. **William Nketsia:** Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Writing - original draft, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank all academics who reviewed the instrument used for data collection. We also appreciate support from the college of education as well as students who participated in this study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e22736.

References

[1] D.P. Bryant, B.R. Bryant, Assistive Technology for People with Disabilities, second ed., Pearson, 2013.
[2] L.W. Heward, Exceptional Children: an Introduction to Special Education, Pearson, 2013.
[3] H. Lee, R. Templeton, Ensuring equal access to technology: providing assistive technology for students with disabilities, Theor. Pract. 47 (3) (2008) 212–219, https://doi.org/10.1080/00405840802153874.
[4] R. Pogrund, D.W. Smith, A short-term training model on assistive technology: perceptions of preservice teachers of students with visual impairments, Insight Res. Pract. Vis. Impair. Blind. 5 (2) (2012) 100–110.
[5] B.J. Reed, S.P. Saladin, Assistive technology, in: Andrew D. Jason, Faubion W. Clayton (Eds.), Rehabilitation Services: an Introduction for the Human Services Professional, third ed., Aspen Professional Services, 2014.
[6] L. Chmiliar, Perspectives on assistive technology: what teachers, health professionals, and speech and language pathologists have to say, Dev. Disabil. Bull. 35 (2007) 1–17.
[7] S. Flanagan, E.C. Bouck, J. Richardson, Middle school special education teachers' perceptions and use of assistive technology in literacy instruction, Assist. Technol. 25 (1) (2013) 24–30, https://doi.org/10.1080/10400435.2012.682697.
[8] L. Markauskaite, Gender issues in preservice teachers' training: ICT literacy and OL, Australas. J. Educ. Technol. 22 (1) (2006) 1–20, https://doi.org/10.14742/ajet.1304.
[9] D.W. Sanders, A.I. Morrison-Shetlar, Student attitudes toward web-enhanced instruction in an introductory biology course, J. Res. Comput. Educ. 33 (3) (2001) 251–262, https://doi.org/10.1080/08886504.2001.10782313.
[10] S. Papadakis, Evaluating pre-service teachers' acceptance of mobile devices with regards to their age and gender: a case study in Greece, Int. J. Mobile Learn. Organisat. 12 (4) (2018) 336–352.
[11] W. Nketsia, M.P. Opoku, A.H. Mohammed, E.O. Kumi, R. Twum, E.A. Kyere, Preservice training amid a pandemic in Ghana: predictors of online learning success among teachers, Frontiers in Education 6 (2021) 1–11, https://doi.org/10.3389/feduc.2021.745623.
[12] S. Parkman, D. Litz, N. Gromik, Examining pre-service teachers' acceptance of technology-rich learning environments: a UAE case study, Educ. Inf. Technol. 23 (3) (2018) 1253–1275, https://doi.org/10.1007/s10639-017-9665-3.
[13] United Arab Emirates University, College of Education Enrolment Data, 2021. https://cedu.uaeu.ac.ae/en/about/enrollmentdata2021.pdf.
[14] S. Al Alaleeli, Empowering female pre-service teachers through culturally responsive teaching: shared and divergent views of Arab and expatriate teacher educators in the United Arab Emirates, Educ. 3-13 50 (5) (2022) 592–611, https://doi.org/10.1080/03004279.2021.1876133.
[15] B. Modarress, A. Ansari, D.L. Lockwood, Emiratisation: from policy to implementation, Int. J. Hum. Resour. Dev. Manag. 13 (2–3) (2013) 188–205, https://doi.org/10.1504/IJHRDM.2013.055395.
[16] World Health Organisation, World Disability Report, Author, Geneva, 2011.
[17] M.P. Opoku, F. J, K. Swabey, D. Pullen, T. Dowden, Assisting individuals with disabilities via the united nations' sustainable development goals: a case study in Ghana, Sustain. Dev. 27 (1) (2019) 175–182, https://doi.org/10.1002/sd.1899.
[18] U. Sharma, T. Loreman, S. Macanawai, Factors contributing to the implementation of inclusive education in Pacific Island countries, Int. J. Incl. Educ. 20 (4) (2016) 397–412, https://doi.org/10.1080/13603116.2015.1081636.
[19] U. Sharma, C. Forlin, M. Marella, F. Jitoko, Using indicators as a catalyst for inclusive education in the Pacific Islands, Int. J. Incl. Educ. 21 (7) (2017) 730–746, https://doi.org/10.1080/13603116.2016.1251979.
[20] U. Sharma, F. Jitoko, S.S. Macanawai, C. Forlin, How do we measure implementation of inclusive education in the Pacific Islands? A process for developing and validating Disability-Inclusive Indicators, Int. J. Disabil. Dev. Educ. 65 (6) (2018) 614–630, https://doi.org/10.1080/1034912X.2018.1430751, 2018.
[21] E.P. Tudzi, J.T. Bugri, A.K. Danso, Human rights of students with disabilities in Ghana: accessibility of the university built environment, Nordic Journal of Human Rights 35 (3) (2017) 275–294, https://doi.org/10.1080/18918131.2017.1348678.
[22] United Nations, Convention on the Rights of Persons with Disabiliteis, Author, New York, 2007.
[23] E. Gaad, M. Almotairi, Inclusion of student with special needs within higher education in UAE: issues and challenges, J. Int. Educ. Res. 9 (4) (2013) 287–292.
[24] E. Gaad, Inclusive Education in the Middle East, Routledge, London, 2011.
[25] E. Gaad, Educating learner with special needs and disabilities in the UAE: reform and Innovation, in: K. Gallagher (Ed.), Education in the United Arab Emirates, Springer, 2019, pp. 147–160, https://doi.org/10.1007/978-981-13-7736-5.
[26] L. Gibson, F. Obiakor, Computer-Based Technology for Special and Multicultural Education: Enhancing 21st Century Learning, Plural Publishing, 2018.
[27] M. Takala, R. Pirttimaa, M. Törmänen, Research section: inclusive special education: the role of special education teachers in Finland, Br. J. Spec. Educ. 36 (3) (2009) 162–173, https://doi.org/10.1111/j.1467-8578.2009.00432.x.
[28] D.L. Voltz, Preparing general education teachers for inclusive settings: the role of special education teachers in the professional development school context, Learn. Disabil. Q. 24 (4) (2001) 288–296, https://doi.org/10.2307/1511117.
[29] R. Hillel Lavian, Masters of weaving: the complex role of special education teachers, Teachers and Teaching 21 (1) (2015) 103–126, https://doi.org/10.1080/13540602.2014.928123, 2.
[30] E. Monteiro, A.C. Kuok, A.M. Correia, C. Forlin, V. Teixeira, Perceived efficacy of teachers in Macao and their alacrity to engage with inclusive education, Int. J. Incl. Educ. 23 (1) (2019) 93–108, https://doi.org/10.1080/13603116.2018.1514762.
[31] U. Sharma, T. Loreman, C. Forlin, Measuring teacher efficacy to implement inclusive practises, J. Res. Spec. Educ. Needs 12 (1) (2012) 12–21, https://doi.org/10.1111/j.1471-3802.2011.01200.x.
[32] L. Florian, K. Young, M. Rouse, Preparing teachers for inclusive and diverse educational environments: studying curricular reform in an initial teacher education course, Int. J. Incl. Educ. 14 (7) (2010) 709–722, https://doi.org/10.1080/13603111003778536.

[33] C. Forlin, D. Chambers, Teacher preparation for inclusive education: increasing knowledge but raising concerns, Asia Pac. J. Teach. Educ. 39 (1) (2011) 17–32, https://doi.org/10.1080/1359866X.2010.540850.

[34] H. Elhoweris, E. Efthymiou, Inclusive and special education in the middle east, in: Oxford Research Encyclopedia of Education, Oxford University Press, 2020, https://doi.org/10.1093/acrefore/9780190264093.013.1219.

[35] V. Gewin, Five tips for moving to teach online as COVID-19 takes hold, Nature 580 (2020) 295–296, https://doi.org/10.1038/d41586-020-00896-7.

[36] K.A. Ansari, F. Farooqi, S.Q. Khan, M. Alhareky, M.A.C. Trinidad, T. Abidi, Perception on teaching and learning health sciences students in higher education institutions during the COVID-19 lockdown–Ways to improve teaching and learning in Saudi colleges and universities, F1000Research. 10 (177) (2021) 1–16, https://doi.org/10.12688/f1000research.28178.

[37] M. Casacchia, M. Cifone, L. Giusti, L. Fabiani, R. Gatto, L. Lancia, R. Roncone, Distance education during COVID 19: an Italian survey on the university teachers' perspectives and their emotional conditions, BMC Med. Educ. 21 (1) (2021) 1335, https://doi.org/10.1186/s12909-021-02780-y.

[38] K.A. Demir, Smart education framework, Smart Learning Environments 8 (1) (2021) 1–36, https://doi.org/10.1186/s40561-021-00170-x.

[39] J. Dron, Smart learning environments, and not so smart learning environments: a systems view, Smart Learning Environments 5 (1) (2018) 1–20, https://doi.org/10.1186/s40561-018-0075-9.

[40] Y. Gambo, M.Z. Shakir, Review on self-regulated learning in smart learning environment, Smart Learning Environments 8 (2021) 1–14, https://doi.org/10.1186/s40561-021-001578.

[41] B. Gros, The design of smart educational environments, Smart learning environments 3 (2016) 1–11, https://doi.org/10.1186/s40561-016-0039-x.

[42] United Arab Emirates Ministry of Education, SMART School Transformation Framework, Author, 2017. https://www.moe.gov.ae/En/ImportantLinks/Pages/SMARTLearning.aspx.

[43] S. Mumtaz, Factors affecting teachers' use of information and communications technology: a review of the literature, J. Inf. Technol. Teach. Educ. 9 (3) (2000) 319–342, https://doi.org/10.1080/14759390000200096.

[44] R.H. Kay, Evaluating strategies used to incorporate technology into preservice education: a review of the literature, J. Res. Technol. Educ. 38 (4) (2006) 383–408, https://doi.org/10.1080/15391523.2006.10782466.

[45] S. Prestridge, Examining the shaping of teachers' pedagogical orientation for the use of technology, Technol. Pedagog. Educ. 26 (4) (2017) 367–381, https://doi.org/10.1080/1475939X.2016.1258369.

[46] F.D. Davis, A. Marangunic, A. Granic, Technology Acceptance Model: 30 Years of TAM, Springer, 2020.

[47] Asghar, Muhammad Zaheer, Elena BarberÃ, Iram Younas, Mobile learning technology readiness and acceptance among pre-service teachers in Pakistan during the COVID-19 pandemic, Knowledge Management & E-Learning: Int. J. 13 (1) (2021) 83–101, https://doi.org/10.34105/j.kmel.2021.13.005.

[48] M.Z. Asghar, Y.K. Erdoğmuş, P. Seitamaa-Hakkarainen, Cultural levels and pre-service teachers' behaviour towards the use of open educational resources, J. Interact. Media Educ. 13 (1) (2021) 1–16, https://doi.org/10.5334/jime.674.

[49] M.Z. Asghar, A. Iqbal, P. Seitamaa-Hakkarainen, E. Barbera, Breaching learners' social distancing through social media during the COVID-19 pandemic, Int. J. Environ. Res. Publ. Health 18 (21) (2021 Oct 20), 11012, https://doi.org/10.3390/ijerph182111012.

[50] C.S. Nam, S. Bahn, R. Lee, Acceptance of assistive technology by special education teachers: a structural equation model approach, Int. J. Hum. Comput. Interact. 29 (5) (2013) 365–377, https://doi.org/10.1080/10447318.2012.711990.

[51] F.D. Davis, A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results, Doctoral dissertation, Massachusetts Institute of Technology), 1985.

[52] I. Ajzen, The theory of planned behaviour: reactions and reflections, Pyschology & Health 26 (9) (2011) 1113–1127, https://doi.org/10.1080/08870446.2011.613995.

[53] I. Ajzen, The theory of planned behavior, Organ. Behav. Hum. Decis. Process. 50 (2) (1991) 179–211, https://doi.org/10.1016/0749-5978(91)90020-T.

[54] R. Alghamdi, Teachers' perceptions of assistive technology use for students with disabilities, Journal of Digital Learning in Teacher Education (2021) 1–15, https://doi.org/10.1080/21532974.2021.1998812.

[55] M. Fishbein, I. Ajzen, Belief, Attitude, Intention, and Behavior, Wiley, NewYork, 1975.

[56] N. Marangunić, A. Granić, Technology acceptance model: a literature review from 1986 to 2013, Univers. Access Inf. Soc. 14 (1) (2015) 81–95, https://doi.org/10.1007/s10209-014-0348-1.

[57] Y. Lee, K.A. Kozar, K.R. Larsen, The technology acceptance model: past, present, and future, Commun. Assoc. Inf. Syst. 12 (1) (2003) 50, https://doi.org/10.17705/1CAIS.01250.

[58] S.H. Liu, H.L. Liao, C.J. Peng, Applying the technology acceptance model and flow theory to online e-learning users' acceptance behavior, E-learning VI (2) (2005) 175–181, https://doi.org/10.48009/2_iis_2005_175-181.

[59] F.D. Davis, Technology acceptance model: TAM, in: M.N. Al-Suqri, A.S. Al-Aufi (Eds.), Information Seeking Behavior and Technology Adoption, 1989, pp. 205–219.

[60] S.C. Chen, L. Shing-Han, L. Chien-Yi, Recent related research in technology acceptance model: a literature review, Aust. J. Bus. Manag. Res. 1 (9) (2011) 124–144.

[61] V. Venkatesh, F. Davis, A theoretical extension of the technology acceptance model: four longitudinal field studies, Manag. Sci. 46 (2) (2000) 186–204, 2000.

[62] K. Gallagher, Introduction: education in the UAE-context and themes, in: K. Gallagher (Ed.), Education in the United Arab Emirates, Springer, 2019, pp. 1–18, https://doi.org/10.1007/978-981-13-7736-5.

[63] N. Siyam, Factors impacting special education teachers' acceptance and actual use of technology, Educ. Inf. Technol. 24 (3) (2019) 2035–2057, https://doi.org/10.1007/s10639-018-09859-y.

[64] C. Atanga, B.A. Jones, L.E. Krueger, S. Lu, Teachers of students with learning disabilities: assistive technology knowledge, perceptions, interests, and barriers, J. Spec. Educ. Technol. 35 (4) (2020) 236–248, https://doi.org/10.1177/0162643419864858.

[65] S. Keown, M. Smothers, T. Colson, Preservice teachers' attitudes and knowledge towards assistive technology: exploring and in-class workshop approach, Kentucky Teacher Education Journal: The Journal of the Teacher Education Division of the Kentucky Council for Exceptional Children 8 (1) (2021) 1–25.

[66] E.Y.E. Ahmed, Impact of some variables on attitudes of pre-service teachers toward using assistive technology among children with learning disabilities in resource rooms, International Journal of Scientific Research in Science and Technology (IJSRST) 1 (4) (2015) 207–218.

[67] J. Borg, S. Larsson, P.O. Östergren, The right to assistive technology: for whom, for what, and by whom? Disabil. Soc. 26 (2) (2011) 151–167, https://doi.org/10.1080/09687599.2011.543862.

[68] J. Corkett, M. Kariuki, D. Brackenreed, K. Waller, Pre-service teacher's perceptions of high-tech assistive technology, in: Society for Information Technology & Teacher Education International Conference, Association for the Advancement of Computing in Education (AACE), 2011, pp. 3625–3629.

[69] J. Corkett, T. Benevides, Pre-service teachers' perceptions of technology and multiliteracy within the inclusive classroom, International Journal of Psychology and Educational Studies 2 (2) (2015) 35–46, https://doi.org/10.17220/ijpes.2015.02.004.

[70] K. O'Sullivan, A. McGrane, S. Long, K. Marshall, M. Maclachlan, Using a systems thinking approach to understand teachers perceptions and use of assistive technology in the republic of Ireland, Disabil. Rehabil. Assist. Technol. (2021) 1–9, https://doi.org/10.1080/17483107.2021.1878297.

[71] R. Satsangi, B. Miller, M.N. Savage, Helping teachers make informed decisions when selecting assistive technology for secondary students with disabilities, Prev. Sch. Fail.: Alternative Education for Children and Youth 63 (2) (2019) 97–104, https://doi.org/10.1080/1045988X.2018.1483314.

[72] S. Wheeler, Information and communication technologies and the changing role of the teacher, J. Educ. Media 26 (1) (2001) 7–17, https://doi.org/10.1080/1358165010260102.

[73] C.H. Chen, Why do teachers not practice what they believe regarding technology integration? J. Educ. Res. 102 (1) (2008) 65–75, https://doi.org/10.3200/JOER.102.1.65-75.

[74] L. Chmiliar, B. Cheung, Assistive technology training for teachers–innovation and accessibility online, Dev. Disabil. Bull. 35 (2007) 18–28.

[75] G. Kessler, Formal and informal CALL preparation and teacher attitude toward technology, Comput. Assist. Lang. Learn. 20 (2) (2007) 173–188, https://doi.org/10.1080/09588220701331394.

[76] G. Russell, G. Finger, N. Russell, Information technology skills of Australian teachers: implications for teacher education, J. Inf. Technol. Teach. Educ. 9 (2) (2000) 149–166, https://doi.org/10.1080/14759390000200087.
[77] L. Wang, P.A. Ertmer, T.J. Newby, Increasing preservice teachers' self-efficacy beliefs for technology integration, J. Res. Technol. Educ. 36 (3) (2004) 231–250, https://doi.org/10.1080/15391523.2004.10782414.
[78] Y. Zhao, G.A. Cziko, Teacher adoption of technology: a perceptual control theory perspective, J. Technol. Teach Educ. 9 (2001) 5–30.
[79] L. Zhou, A.T. Parker, D.W. Smith, N. Griffin-Shirley, Assistive technology for students with visual impairments: challenges and needs in teachers' preparation programs and practice, J. Vis. Impair. Blind. (JVIB) 105 (4) (2011) 197–210.
[80] P. Karlsson, C. Johnston, K. Barker, Influences on students' assistive technology use at school: the views of classroom teachers, allied health professionals, students with cerebral palsy and their parents, Disabil. Rehabil. Assist. Technol. 13 (8) (2018) 763–771, https://doi.org/10.1080/17483107.2017.1373307.
[81] G.H. Abner, E.A. Lahm, Implementation of assistive technology with students who are visually impaired: teachers' readiness, J. Vis. Impair. Blind. (JVIB) 96 (2) (2002) 98–105.
[82] C.H. Kimm, J. Kim, E.O. Baek, P. Chen, Pre-service teachers' confidence in their ISTE technology-competency, Journal of Digital Learning in Teacher Education 36 (2) (2020) 96–110, https://doi.org/10.1080/21532974.2020.1716896.
[83] C. Morgan, The experiences of disabled people in the United Arab Emirates: barriers to participation in higher education and employment, Disabil. Soc. 38 (3) (2023) 421–444, https://doi.org/10.1080/09687599.2021.1930520.
[84] E. Babbie, Introduction to Social Research, fifth ed., Cengage Learning, Wadsworth, 2011.
[85] S. Mengual-Andrés, R. Roig-Vila, J.B. Mira, Delphi study for the design and validation of a questionnaire about digital competences in higher education, International Journal of Educational Technology in Higher Education 13 (1) (2016) 1–11, https://doi.org/10.1186/s41239-016-0009-y.
[86] J. Pallant, SPSS Survival Manual, seventh ed., Open University Press, 2020.
[87] R.L. Worthington, T.A. Whittaker, Scale developmetn research: a content analysis and recommendation for best practices, Counsel. Psychol. 34 (6) (2006) 806–834, https://doi.org/10.1177/0011000006288127.
[88] B.M. Byrne, Structural Equation Modelling with AMOS: Basic Concepts, Applications and Programming, third ed., Routledge, London, 2014.

Dr Maxwell Peprah Opoku is currently an Assistant Professor in Special Education at the United Arab Emirates University. Before Joining UAEU, he worked as casual academic, teaching undergraduate and graduate courses at Faculty of Education, University of Tasmania, Australia. He holds a PhD in Education from University of Tasmania, Australia

Prof Hala Elhoweris is a professor and acting dean of College of Education, United Arab Emirates University.

Dr Najwa Alhosani is an Associate Professor at College of Education, United Arab Emirates University.

Dr Ashraf Moustafa is an instructor in special education at College of Education, United Arab Emirates University. He has extensive experience working in schools supporting the teaching of students with disabilities in Egypt and United Arab Emirates.

Thara Alkhateri is a special education teacher. She holds a special education degree from College of Education, United Arab Emirates University.

Dr William Nketsia joined Western Sydney University (WSU) as a lecturer in Inclusive Education in January 2018. He completed his Doctoral and Masters' Degrees in Education in 2016 and 2011 respectively, from University of Jyvaskyla, Finland. He also has Bachelors' degree in Science Education from University of Cape Coast and Teacher's certificate in Basic Education from Akrokerri College of Education, Ghana. Dr Nketsia has previously worked in University of Jyvaskyla, Finland as a lecturer