Research Article https://doi.org/10.12973/ejmse.4.4.253

European Journal of Mathematics and Science Education

Volume 4, Issue 4, 253 - 268.

ISSN: 2694-2003

http://www.ejmse.com/

Namibian Teachers' Behavioural Intentions on Students' Mathematics Learning Using Their Own Devices

Cloneria Nyambali Jatileni*
University of Eastern Finland, FINLAND

Sari Havu-Nuutinen
University of Eastern Finland, FINLAND

Susanna Pöntinen
University of Eastern Finland, FINLAND

Received: July 24, 2023 ▪ Revised: October 27, 2023 ▪ Accepted: November 10, 2023

Abstract: Bring your own device (BYOD) policy implementation in schools worldwide has allowed students to learn subjects, including mathematics, using personal mobile devices (PMDs). PMD use has enhanced students' mathematics enjoyment by bridging the gap between theoretical mathematics concepts and their practical applications, which makes mathematics more meaningful and leads to improved results. Nonetheless, students in Namibian basic education are not authorised to learn with PMDs in school. While students' PMD use in school remains a topic of debate, there remains a need to investigate its impact on students' mathematics learning and teachers' perceptions of BYOD in mathematics classrooms. This study evaluated the perceptions and intentions of 209 Namibian mathematics teachers from the Omusati and Khomas regions regarding students' mathematics learning using PMDs in schools. Data were collected through an online survey. A structural equation model revealed teachers' positive intentions towards students' use of PMDs through BYOD in learning mathematics in school. Perceived usefulness (PU), perceived ease of use (PEoU), and price value (PV) factors directly affected the teachers' behavioural intentions (BI) towards students learning mathematics through BYOD. PEoU significantly affected teachers' PU, and PV significantly affected teachers' PEoU and PU. PU significantly mediated the relationship between PEoU and teachers' intentions. PV significantly indirectly affected teachers' intentions through PU. PEoU non-significantly mediated the PV and intention relationship. Practical implications are discussed, and recommendations are offered for the Namibian Ministry of Education, Arts and Culture and teacher training institutions.

Keywords: *Behavioural intention, mathematics, perceived ease of use, perceived usefulness, price value.*

To cite this article: Jatileni, C. N., Havu-Nuutinen, S., & Pöntinen, S. (2023). Namibian teachers' behavioural intentions on students' mathematics learning using their own devices. *European Journal of Mathematics and Science Education, 4*(4), 253-268. https://doi.org/10.12973/ejmse.4.4.253

Introduction

The adoption of BYOD in education is an emerging trend, enabling students to use their mobile devices for learning (Sánchez et al., 2020). Emerging educational technologies are promising innovations with the potential to positively impact teaching and learning, gradually becoming part of school cultures (Owan et al., 2022). However, there is no common definition of BYOD among researchers. Some define BYOD as a learning programme, concept, initiative, trend, policy, scheme, project, approach, or method (Aggarwal, 2018; Arifjanova, 2022; Demchenko et al., 2022; French et al., 2015; Keane & Keane, 2022; Mawere et al., 2022; Sánchez et al., 2020; Tsui & Mok, 2019). Although researchers have combined different terms to define BYOD, their definitions generally share a common meaning (Sánchez et al., 2020). In this study, BYOD in a school context refers to students using their laptops, tablets, and smartphones for mathematics learning in the classroom and on school premises (Arifjanova, 2022; Siyam et al., 2022).

Students' use of personal mobile devices (PMDs) under BYOD is a globally debated topic in schools (Mawere et al., 2022). Ongoing debates involve educational stakeholders (students, teachers, parents, and policymakers) on the relevance and feasibility of PMD-assisted learning in schools (Janmaat et al., 2016; Parsons & Adhikari, 2016). While some researchers acknowledge the challenges of implementing BYOD in schools, others emphasise its educational benefits.

BYOD in primary education fosters student engagement, enthusiasm, and learning excitement while also promoting creative development in younger students (Demchenko et al., 2022; Mawere et al., 2022). Arifjanova (2022) predicted that PMDs and BYOD policies would significantly influence the future of education. The incorporation of BYOD-related subjects and curricula has yielded positive outcomes, particularly in English language, geography, and biology education

* **Corresponding author:**
Cloneria Nyambali Jatileni, University of Eastern Finland, Joensuu, Finland. ✉ cloneria.jatileni@uef.fi

(Clark et al., 2021). By contrast, Beneito and Vicente-Chirivella (2020) found a positive effect of banning mobile devices on students' mathematics and science scores. They highlighted their study as one of the first to provide direct evidence in this regard. BYOD proponents argue that PMDs play a valid role in formal education to supplement device shortages in schools. Teachers who permit their use aim to understand students' mathematics learning beyond the classroom (Mawere et al., 2022). Given the prevalence of PMDs, educational stakeholders are encouraged to permit their use for student learning and establish proper usage procedures in schools (Mawere et al., 2022).

Diverse PMDs in the classroom can pose challenges for teachers in BYOD implementation. Teachers may struggle with unfamiliar devices, hindering their ability to assist students during lessons. Additionally, cybersecurity is a school concern (French et al., 2015). Critics argue that BYOD fosters a digital divide among students and may disrupt learning, especially the use of smartphones (Johnson, 2019; Mawere et al., 2022). Consequently, some countries have banned students' use of PMDs in schools (Beneito & Vicente-Chirivella, 2020; Dempsey et al., 2019). However, BYOD policies could be implemented in schools to combat the ever-changing and emerging nature of PMDs to ensure uniformity. In this study, BYOD policies refer to the set of rules that regulate students' use of PMDs for mathematics learning in schools (Arifjanova, 2022).

The Namibian Ministry of Education has not authorised students' use of PMDs in schools for learning because of negative beliefs about PMDs (Osakwe et al., 2017). However, the importance of properly integrating students' PMDs into learning cannot be overemphasised, and authorities should consider their advantages and disadvantages (Clark et al., 2021). However, with proper training and awareness for both students and teachers, BYOD implementation can enhance education and foster students' achievement (French et al., 2015).

Aggarwal (2018) recommended assessing potential challenges before adopting emerging technologies in schools. Moreover, schools should first gain the approval of key educational stakeholders, such as teachers, students and policymakers before introducing BYOD for mathematics learning (Kaisara et al., 2022). Teachers and students, as end users, are pivotal to BYOD implementation. Furthermore, in their role as policy implementers, teachers hold particular significance, as they not only facilitate learning but can also pinpoint BYOD implementation challenges. Hence, their intentions are crucial in enabling students to learn mathematics with PMDs in school.

This study explores teachers' perceptions of students using PMDs to learn mathematics through the BYOD policy in schools, contributing to the ongoing debate on BYOD in education. We employ the technology acceptance model (TAM) to investigate teachers' intentions and opinions. TAM is a well-established framework for assessing teachers' technology adoption, including BYOD (Mawere et al., 2022; Saidu & Al Mamun, 2022). First, we evaluate how PU, PEoU, and PV directly impact teachers' intentions towards students' use of PMDs through BYOD to learn mathematics in schools. Second, we analyse the direct effects of PEoU on PU and PV on PU and PEoU. Third, we assess the indirect effects of teachers' PEoU and PU on their BI. Our study combines an analysis of direct and mediated effects to comprehensively capture the relevant methodological and theoretical aspects. This ambitious approach aims to provide a holistic understanding of the bigger picture related to BYOD.

Literature Review

Bring Your Own Device

Previous research on BYOD implementation in schools primarily focused on students' intentions, with less emphasis on teachers' perspectives (Aggarwal, 2018; Clark et al., 2021; Hakami, 2020; Masilo et al., 2021; Mozelius et al., 2020; Nuhoğlu Kibar et al., 2020; Sánchez et al., 2020; Siyam et al., 2022; Tinmaz & Lee, 2019). These studies discussed the advantages and challenges of BYOD use in education and its impact on subjects other than mathematics. Mawere et al. (2022) and Siyam et al. (2022) utilised the TAM to examine teachers' perceptions and intentions towards PMD use in schools in the Global South and BYOD use in the classroom, respectively. However, these studies did not specifically focus on the use of BYOD for mathematics learning. Other studies have employed different theoretical approaches to understand teachers' opinions of BYOD in education. Kaisara et al. (2022) noted a scarcity of literature on PMD use in education, particularly from an African perspective. Further research is required to address limitations and extend the understanding of the PMDs' effects on mathematics teaching and learning (Fabian & Topping, 2019), and there is a dearth of research on BYOD from the perspective of educational stakeholders (Tsui & Mok, 2019).

Students who use PMDs in educational settings have demonstrated the value that BYOD adds to their learning (French et al., 2015). Furthermore, Poláková and Klímová (2019) showed that PMD use has a positive effect on students' achievement and lesson enjoyment. Additionally, Suprianto et al. (2019) reported a significant increase in the autonomous learning outcomes of students who learn mathematics using PMDs. BYOD also facilitates easy contact between students and teachers, leading to improvements in students' algebraic thinking skills (Rudyanto et al., 2019). Although prolonged PMD use was associated with a significant increase in adolescent academic performance, it significantly decreased their achievement scores in mathematics and English (Liu et al., 2020).

The BYOD implementation in schools has been criticised by teachers, parents, policymakers, and students (Tsui & Mok, 2019). In addition, teachers have argued that BYOD is unnecessary in schools and that some students do not own or that their parents cannot afford PMDs (Alalwan et al., 2020). Further, they claimed that students do not fully take responsibility for the upkeep of their PMDs (Alalwan et al., 2020) and that many parents oppose BYOD policies that make PMD use mandatory in learning (Alalwan et al., 2020). Parents have described BYOD as a source of distraction, which makes parental intervention increasingly difficult and ultimately increases the burden of parenting (Page Jeffery, 2022). Similarly, students and parents share worries about students learning with PMDs in school, specifically that it may replace some important pen-and-paper learning methods (Tsui & Mok, 2019). However, despite health concerns related to students' prolonged use of PMDs, many parents believe that PMDs provide easier access to learning resources and can enhance learning motivation (Tsui & Mok, 2019).

The literature review recommends studies on teachers' opinions, with a specific focus on BYOD implementation in schools, particularly in developing countries like Namibia. None of the reviewed research used the TAM to comprehend basic education mathematics teachers' intentions related to students' mathematics learning using PMDs through BYOD. This research gap highlights the need to examine teachers' intentions regarding BYOD implementation in basic education. Hence, to address this gap, our study utilises the TAM to explore teachers' intentions towards the adoption of BYOD for mathematics in the context of basic education in Namibia.

Technology Acceptance Model

This study uses the TAM because it incorporates a limited number of factors, which enhances comprehension of findings, and has high predictive capability regarding the acceptance of educational technology (Saidu & Al Mamun, 2022; Salloum et al., 2019). TAM is an information systems theory that explains technology acceptance by individuals (McCord, 2007). Davis (1989) developed the TAM from the theory of reasoned action limitations, which only provided a psychological perspective on human behaviour and lacked the information systems aspect (Davis, 1993). The TAM extended into three models (Chuttur, 2009), which elucidate the practices underlying technology acceptance, predict users' behaviour, and provide a theoretical explanation for the success of technology implementation (Davis, 1989, 1993; McCord, 2007). Practically, the TAM informs practitioners of the measures to take before implementing technological systems, such as BYOD in the mathematics classroom (Durodolu, 2016).

In this study, the TAM provides the foundation for ascertaining teachers' perceived impact of PMD use on students' mathematics learning as well as the teachers' intentions related to BYOD in schools. TAM predicts technology acceptance based on users' intentions, which are influenced by the perceived usefulness and ease of use of the technology (McCord, 2007). Our study evaluates the main TAM factors—behavioural intentions, perceived usefulness, and perceived ease of use—examining teachers' perceptions of BYOD's usefulness, ease of use for their students, and provision and availability of PMDs to students.

Although the TAM is a strong model for predicting technology acceptance, Granić and Marangunić (2019) proposed adding other factors to the original TAM constructs, which explains why there are three TAM models. In this study, we added PV to the TAM factors to account for PMD availability and provision to students in the Namibian context. The TAM is often combined with the unified theory of acceptance and use of technology constructs to form a unified model (Chatterjee et al., 2020). Adding PV to the TAM in our study can theoretically contribute to the literature in a distinct way.

The TAM includes two outcome factors: BI and *actual use* (Davis, 1989). BI refers to the willingness to attain the target behaviour (Chatterjee et al., 2020). Based on the TAM, teachers' intentions to accept educational technology are determined by their PU and PEoU (Aggarwal, 2018). Teachers' positive intentions towards students learning mathematics with PMDs through BYOD in school are likely to lead to supportive behaviour. BI is the dependent variable in this study and is influenced by the independent variables, in alignment with our first objective.

PU is the degree to which a person believes that technology can enhance their job performance or improve their learning (Davis, 1989; Mailizar et al., 2021). PU affects teachers' BI both directly and indirectly (Camadan et al., 2018; Mailizar et al., 2021). A high PU system is one in which participants believe in a positive relationship between use and performance (Davis, 1989). If teachers believe that BYOD can improve mathematics teaching, enhance learning, and improve student performance, then they would have a high positive PU towards PMD use through BYOD in school (Aggarwal, 2018), which would positively affect their BI.

PEoU is the extent to which an individual believes that using a certain technology requires less physical and mental effort (Davis, 1989; Saidu & Al Mamun, 2022). PEoU directly affects teachers' PU and their BI (Saidu & Al Mamun, 2022). Users prefer easier-to-use applications (Davis, 1989). If teachers perceive that learning mathematics with PMDs requires less effort for students, then they are more likely to accept BYOD. Thus, PEoU affects teachers' PU and BI towards BYOD for mathematics learning in school, and vice versa.

Price or cost value (PV) refers to the monetary value of a product or service—that is, whether it is worthwhile to spend money on a product or service (Bower et al., 2020). Teachers are not responsible for purchasing PMDs. This factor was only used to examine their perceptions of PMD provision by parents, the Ministry of Education, and students. If teachers believe that educational stakeholders would provide students with PMDs, then teachers' perceived PV would significantly affect their intentions towards BYOD for mathematics learning in school (Chatterjee et al., 2020).

The mediated effect helps researchers test theoretical models with multiple linkages between factors (Hayes, 2009). To achieve our third objective, we examined how PU and PEoU mediate the effects of PV on teachers' BI. PEoU directly affects teachers' PU and indirectly influences their BI (Davis, 1989; Saidu & Al Mamun, 2022). Two mediators, PEoU and PU, influence intention to use technology (Davis, 1989). Our study employed a two-path analysis to assess the mediating effect of PU and PEOU on the relationship between PV and BI. As PU and PEoU are mediators according to the TAM, we assess their mediating role in the link between PV and BI. The study is guided by five research questions (RQs), on which we base nine hypotheses. Figure 1 shows the proposed study model with the hypotheses and paths.

RQ1: How do teachers' PU, PEoU and PV directly relate to their BI towards students' learning of mathematics through BYOD in school?

H_1: PU has a statistically significant positive direct effect on teachers' BI.

H_2: PEoU has a statistically significant positive direct effect on teachers' BI.

H_3: PV has a statistically significant positive direct effect on teachers' BI.

RQ2: How does teachers' PEoU directly relate to their PU towards students' learning of mathematics through BYOD in school?

H_4: PEoU has a statistically significant, positive effect on teachers' PU.

RQ3: How does PV directly affect teachers' PEoU and PU towards students' learning of mathematics through BYOD in school?

H_5: PV has a statistically significant direct positive effect on teachers' PEoU.

H_6: PV has a statistically significant direct positive effect on teachers' PU.

RQ4: What is the mediating role of teachers' PU on the relationships between PEoU and BI and between PV and BI towards students' learning of mathematics through BYOD in school?

H_7: PU statistically and significantly mediates the PEoU effect on teachers' BI.

H_8: PU statistically and significantly mediates the PV effect on teachers' BI.

RQ5: What is the mediating role of PEoU on the relationship between teachers' PV and BI towards students' learning of mathematics through BYOD in school?

H_9: PEoU statistically and significantly mediates the PV effect on teachers' BI.

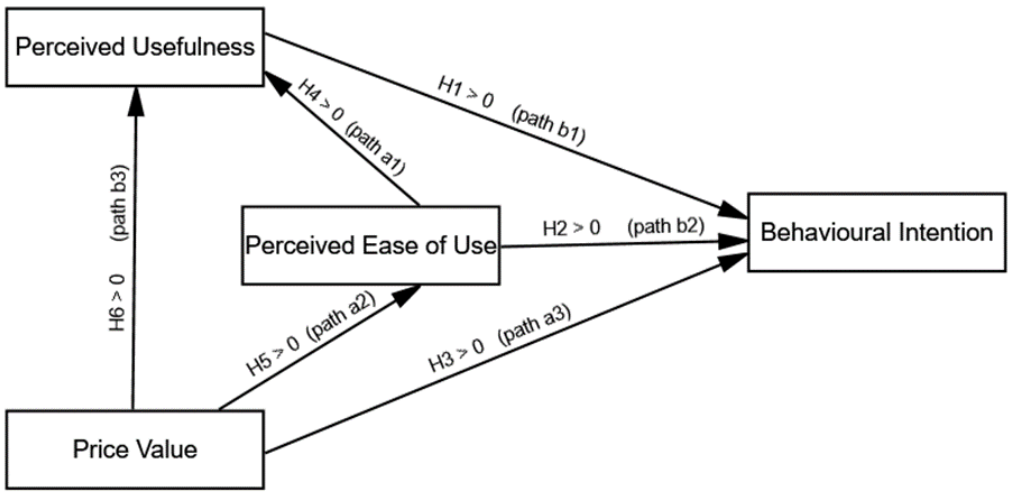

Figure. 1. Proposed Technology Acceptance Model With Hypotheses and Paths

Methodology

Instruments

We used a close-ended self-administered online survey to gather data from teachers on their intentions towards students' learning of mathematics with PMDs in school. Given the novelty of the topic under study, we could not find an exact survey tool with the same focus as ours during instrument development. However, our study's aims and objectives closely align with those of prior studies (Chatterjee et al., 2020; Hoi & Mu, 2021; Xu & Zhu, 2020) and their survey tools. We conducted a review of their survey instruments, considering our study's desired population, context, and objectives. To validate our own survey, we adopted existing survey items that assessed items similar to those in our study. Additionally, we conducted a pilot study with 50 teachers to evaluate their BYOD knowledge and perceptions and to assess the survey tool's reliability, following Lowe's (2019) approach. Validity was established through factor analysis, ensuring that the items loaded appropriately onto their respective components and assessing item correlations. We also had experts in the field review the tool to confirm that it covered the theoretical construct being measured. Items with too low or too high correlations, those that did not fit into any factor, and those that loaded on multiple components were removed from the final tool. The final survey contained 12 questions. The first five questions gathered demographic data on the participants, including gender, age, teaching experience, qualification, and region. The other 7 questions consisted of 38 items, which were grouped into seven factors. Four of these factors (BI, PU, PEoU, and PV) formed the basis of this study. The other two factors were not included in this paper. The survey used a five-point Likert scale, with which participants could express how much they agreed or disagreed with the survey statements (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). To avoid partial responses and missing data, responses to all items on the survey tool were mandatory (Décieux et al., 2015).

Data Collection

The study used volunteer purposeful sampling of grade 4–12 mathematics teachers from the Omusati and Khomas regions. Purposive sampling was used to improve the rigour of this study and the trustworthiness of the data and results by producing a match between the sample, aims, and study objectives (Campbell et al., 2020). The participating teachers did not experience BYOD in their schools. However, the researcher generally introduced the BYOD concept on the survey's front page to ensure that the participants shared a common understanding. Additionally, participants were instructed to respond honestly. Some participants requested a further explanation of the BYOD for mathematics learning concepts, to which the researcher provided a general explanation without discussing its pros and cons. Although the survey was online and self-administered, not all schools in the participating regions had active school websites to easily find the contact details of mathematics teachers. To collect data from only mathematics teachers in the two regions, the researcher moved from one school to another, presenting the research idea, collecting the written informed consent forms, and sharing the survey link with the intended participants. In cases where teachers did not have mobile devices to access the survey, the researcher had extra devices for them to use. Some schools, especially in rural areas, did not have a Wi-Fi internet connection. To ensure the participation of mathematics teachers from those schools, the researcher used an internet pocket device router to supply a Wi-Fi connection. Data were collected between March and June 2022.

Participants

A total of 209 grade 4–12 mathematics teachers, 40% males and 60% females, from both the Omusati and Khomas regions completed the online survey. These regions are among those with the highest teacher populations in the country. The Khomas region represents urban schoolteachers, while the Omusati region represents rural schoolteachers.

Table 1 shows the participants' demographic information based on region and gender. Of the teachers, 60% (48 males and 76 females) were from the Omusati region, while 41% (36 males and 49 females) were from the Khomas region. Moreover, the table shows the participants' academic qualifications in education. Most (58%) of the participants had a bachelor's degree, 16% had master's degrees, 13% had a diploma, and 8% had a doctorate. A small minority (5%) of the mathematics teachers had no qualifications in education. The table further presents the participants' age groups. More than half (51%) of the teachers were between the ages of 22 and 30, 28% were between 31 and 40, 13% were between 41 and 50, and 9% were between 51 and 60. Table 1 indicates the participants' years of teaching experience. The largest proportion, 30%, were novice teachers, 24% had taught for about three years, and 23% had taught for 10 years or more. Sixteen percent of teachers had taught between 4 and 6 years, while 7% had 7 to 9 years of teaching experience.

The number of teacher participants provided a limited representation of approximately 15,000 mathematics teachers nationwide, and their perceptions might not entirely represent the opinions of all Namibian mathematics teachers. However, the sample was representative of the Namibian teacher population (Ministry of Education, Arts and Culture Republic of Namibia, 2022).

Table 1. Participants' Demographic Information

		Gender		
Region		**Male**	**Female**	**Total**
	Omusati	48	76	124
	Khomas	36	49	85
Total		**84**	**125**	**209**
Qualification in education	Diploma	14	13	27
	Bachelor's degree	46	76	122
	Master's degree	12	21	33
	Doctorate (PhD)	8	8	16
	Unqualified	4	7	11
Total		**84**	**125**	**209**
Age group	22–30	30	76	106
	31–40	23	35	58
	41–50	22	5	27
	51–60	9	9	18
Total		**84**	**125**	**209**
Teaching experience	Less than 1 year	21	41	62
	1–3 years	20	30	50
	4–6 years	7	27	34
	7–9 years	5	9	14
	More than10 years	31	18	49
Total		**84**	**125**	**209**

Data Analysis

The dataset was extracted from the Webropol survey system for analysis using the Statical Package for the Social Sciences (SPSS.27) and IBM Amos 27. Teachers' perceptions and intentions towards students' learning of mathematics with PMDs through BYOD in school were examined through a series of quantitative analyses. Principal component analysis (PCA), correlation tests, reliability tests, confirmatory factor analysis, and structural equation modelling (SEM) analyses were performed to establish the relationship between the components and their items. PCA extraction with varimax, suppressing small coefficients, sorting them by size, and accepting absolute values > .50, was applied to the items. The PCA generated six components with eigenvalues >1, which were retained based on the Kaiser criterion; the rest were deleted (Courtney, 2013). Four of the six retained factors were used in this study (see Table 2), while the rest were used in a different study. Eight items loaded on the first component. Five of these items were grouped under behavioural action, while the other three were grouped under BI factors on the survey tool. In the PCA, these eight items were arranged as one component, and the items that strongly loaded on this component were grouped under BI on the survey. The strongly loaded factor items determine the factor's name (Strickland, 2003). Our first component was BI. Seven items were loaded on the second component, PU. Three items loaded on the third component, PV, while two items loaded on the fourth component, PEoU. Table 1 presents the rotated component matrix.

Table 2. Rotated Component Matrixa

	Component loading			
	1	2	3	4
BI1: I think pupils' results will improve if they use their own mobile devices while learning math in school	.836			
BI2: I think it would be a good strategy for pupils to use their own mobile devices while learning math	.768			
BI3: I think it would be a positive idea for pupils to use their own mobile devices for learning in school	.739			
BI4: If allowed, I intend to recommend that my colleagues encourage their pupils to use their own devices to learn math in the future	.723			
BI5: Assuming all pupils will have access to the internet in school, I intend to allow them to use it to learn math	.712			
BI6: I believe it would be advantageous for Namibian pupils to use their own mobile devices to learn math	.709			
BI7: If allowed, I intend to increase pupils' use of their own mobile devices to learn math in school	.676			

Table 2. Continued

	Component loading			
	1	2	3	4
BI8: I think it would be a good idea for the Ministry of Education Arts and Culture to adopt the BYOD policy	.676			
PU1: I think pupils would save time by using their own mobile devices while learning math		.843		
PU2: I believe math learning would be more convenient if pupils use their own mobile devices in classrooms		.771		
PU3: I believe math learning would be more effective if pupils use their own mobile devices in classrooms		.737		
PU4: I believe math learning would be more fun if pupils use their own mobile devices in classrooms		.723		
PU5: I believe using their own mobile devices would make pupils' math learning easier		.703		
PU6: I believe the use of own mobile devices would lead pupils to get better results in math		.663		
PU7: I believe that, in general, pupils use of their own mobile devices to learn math would have been useful		.593		
PV1: I believe parents would value buying their children mobile devices for learning purposes			.825	
PV2: I believe the Ministry of Education Arts and Culture would value supplying mobile devices to schools for learning purposes			.790	
PV3: I believe pupils using their own mobile devices to learn math would bring them a reasonable price value			.785	
PEoU1: I believe pupils' own mobile devices would be easy for them to use while doing math homework				.917
PEoU2: I believe it would be easy for pupils to complete math learning tasks in school using their own mobile devices				.820

Extraction method: Principal component analysis
Rotation method: Varimax with Kaiser normalisation
[a]Rotation converged in six iterations

The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was very good (.94), and Bartlett's Test of Sphericity was significant (p = .000). Therefore, the sample size of 209 was adequate, above the recommended > .50 KMO (Dogbegah et al., 2011). Table 3 presents the number of items, Cronbach's alpha of each component, and composite reliability. The components showed excellent internal consistency, with reliability values of Cronbach's alpha and composite reliability > .70 (Basto & Pereira, 2012; Tegor et al., 2023).

Table 3. Component Information

Component	No. of items	Cronbach's alpha	Composite reliability
Behavioural intention	8	.955	.954
Perceived usefulness	7	.948	.949
Price value	3	.877	.878
Perceived ease of use	2	.858	.954

We computed items under each component to form a construct. The *inter-construct correlation* assesses the extent to which the scores of one construct are related to the scores of the other (Piedmont, 2014). Here, the inter-construct correlation was positive and significant (Table 4). All the constructs positively and significantly correlated with each other (p < .000). The strongest positive observed correlation coefficient (r = .825) was between BI and PU. PU was positively and significantly correlated with PV (r = .671), while BI and PV were positively and significantly correlated (r = .670). PEoU was positively and significantly correlated with PU (r = .522), and PEoU and BI were also positively correlated (r = .533). PV and PEoU were weakly positively and significantly correlated (r = .385). The correlation coefficients of our constructs ranged between the recommended values (r = .4–.8) for inter-construct correlations (Gogtay & Thatte, 2017).

Table 4. Pearson Correlations between the Factors

	PU	BI	PV	PEoU
PU	1	.825**	.671**	.522**
BI	.825**	1	.670**	.533**
PV	.671**	.670**	1	.385**
PEoU	.522**	.533**	.385**	1

**. Correlation is significant at the .01 level (two-tailed).

A *confirmatory factor analysis* (CFA) confirmed the hypothesis of the relationship between the observed variables and the causal latent constructs. CFA tested the factorial validity of the theoretical constructs and verified the items and factor structure (Byrne, 2016). Table 5 presents the CFA assessment of the measurement model. High loadings confirmed that the items were very well explained by the latent factors. Further, CFA confirmed the construct validity and the model measurements, with all items having statistically significant parameters as well as a good model fit: x^2/df = 1.813 (< 5.0), p = .000 < .001, SRMR = .0285 (< .05), RMSEA = .063 (< .08), GFI = .896 (> .80), TLI = .963 (> .90) and CFI = .972 (> .90) (Byrne, 2016; Doll et al., 1995; Jarwa et al., 2021; Li et al., 2020). Our CFA model meets established thresholds. The CFI produced a GFI of 0.896, falling within the range of .80–.89, indicating an acceptable good fit, although it's important to note that a GFI >0.90 is considered an excellent fit (Doll et al., 1995; Hong et al., 2023; Koçak & Göksu, 2023; Qin et al., 2023; Zong et al., 2023). This outcome suggests that our CFA model has produced good results, allowing us to proceed with the SEM analysis confidently.

Table 5. Confirmatory Factor Analysis Results (N = 209)

Construct	Item	Unstandardised estimate	Standardised estimate	*t*-value (C.R)	P-value
Behavioural intention	BI1	.942	.809	16.522	***
	BI2	1.000	.873	-	-
	BI3	.784	.713	14.807	***
	BI4	.991	.865	15.985	***
	BI5	.945	.898	17.255	***
	BI6	.953	.824	15.977	***
	BI7	1.017	.867	21.615	***
	BI8	.948	.868	16.197	***
Perceived usefulness	PU1	.898	.787	15.761	***
	PU2	1.000	.888	-	-
	PU3	.933	.837	17.177	***
	PU4	.950	.824	19.126	***
	PU5	.945	.864	15.789	***
	PU6	.946	.878	15.945	***
	PU7	.863	.851	15.305	***
Price value	PV1	1.085	.844	13.692	***
	PV2	1.000	.819	-	-
	PV3	1.152	.857	13.925	***
Perceived ease of use	PEoU1	.678	.747	9.591	***
	PEoU2	1.000	1.009	-	-

***p < .001.

SEM was used to test the direct and indirect effect of the predictors (PU, PEoU, and PV) on the dependent variable (BI). Further, SEM was used to test the direct effects of PEoU on PU, PV on PU, and PV on PEOU. In the first part of the SEM analysis, we assessed the direct effects of PU, PEoU, and PV on intentions through the model paths b1, b2, and a3, respectively. Next, a multiple mediation analysis was used to assess the indirect effect of the independent variables on the dependent variable through all possible mediators. This analysis tested Venkatesh and Davis' (2000) assumptions that PU and PEoU fully mediate the effect of external variables on participants' intentions. We manually separated the specific indirect effects using the syntax-based user-defined estimand function, which defined the different mediation paths within our model (Collier, 2020). The hypothesised mediation paths (see Figure 1) were tested in a multiple model using a bootstrapping approach to assess the significance of the indirect effects at differing levels of the mediator. A total of 500 bootstrap samples were performed with 95% bias-corrected confidence intervals. In the first mediated path, PU was a mediator of the path (a1b1) between the dependent variable PEoU and the outcome BI. In the second mediated path, PU was a mediator of the path (b3b1) between the dependent variable PV and the outcome BI. In the last mediated path, PEoU was a mediator of the path (a2b2) between the dependent variable PV and the outcome BI.

Results

This study assessed the direct effect of teachers' PU, PEoU, and PV on their BI towards students' learning of mathematics with PMDs in school. The study also evaluated how teachers' PEoU affects their PU. The direct effect between PV and teachers' PU and PEoU was also assessed. Further, the study examined the indirect effects of PV and PEoU on BI. The following section addresses the study's five research questions and nine hypotheses.

Teachers' Intentions Towards Students' Learning of Mathematics Through BYOD in School

To investigate the hypothesised relationships between the factors, an SEM path model was constructed. The model (Figure 2) had an acceptable good fit: x^2/df = 1.994 (< 5.0), p = .000 < .001, SRMR = .0347 (< .05), RMSEA = .067 (< .08), GFI = .883 (> .80), TLI = .956(> .90) and CFI = .965 (> .90) (Byrne, 2016; Jarwa et al., 2021). In line with the study's five research questions, we tested six hypotheses regarding the direct effects of PU, PEoU and PV on teachers' BI. Three other hypotheses were tested based on the mediated effects of PEoU and PU. Estimates of all the path coefficients are presented in Tables 6 and 7.

Figure 3 shows the factors of the SEM theoretical model and their item's standardised beta weights. The value .81 above the BI factor indicates the amount of variance of teachers' intention explained by the predictor variables using standardised regression coefficients (R^2) (i.e. the overall R^2 of the model was .81). In other words, the predictor variables explained 81% of the variance in teachers' intentions towards students' learning of mathematics through BYOD in school.

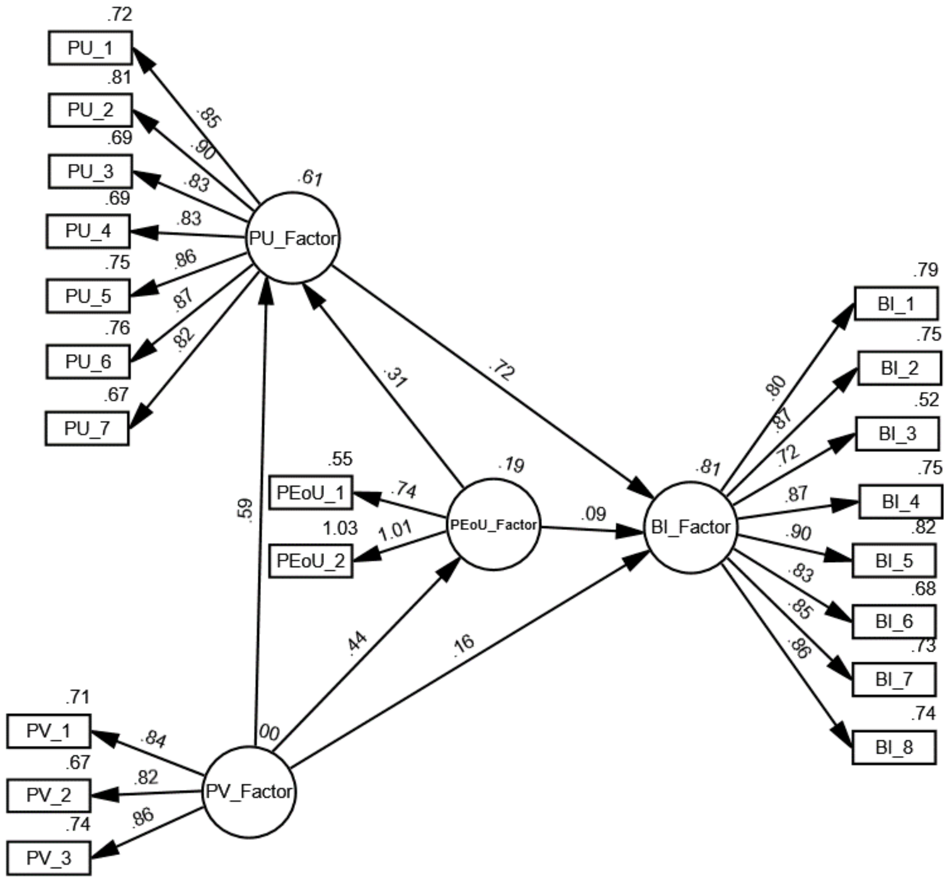

Figure. 2. The Empirical Model With Standardised Factor Estimates

Perceived Usefulness, Perceived Ease of Use, and Price Value Directly Predict Behavioural Intentions

In response to RQ1, Table 6 shows that all factors had a positive direct effect on teachers' BI. PU had a positive and significant direct effect on BI (β = .715, t = 8.972, p = < .001). Therefore, H_1 (PU has a statistically significant, positive, and direct effect on teachers' BI) is accepted. PU was the highest and strongest significant predictor of teachers' BI towards students' learning of mathematics through BYOD in school.

PEoU had a significant, positive, and direct effect on teachers' BI (β = .092, t = 2.055, p = .040 < .05). Consequently, hypothesis H_2 (PEoU has a statistically significant positive direct effect on teachers' BI) is confirmed. However, PEoU was the least significant predictor of teachers' BI towards students' learning of mathematics through BYOD in school.

PV had a positive significant direct effect on BI (β = .165, t = 2.675, p = .007 < .05). Thus, H_3 (PV has a statistically significant positive direct effect on teachers' BI) is accepted. PV was the second-most significant predictor of teachers' BI towards students' learning of mathematics through BYOD in school.

Perceived Ease of Use Predicts Perceived Usefulness

Regarding RQ2, PEoU had a statistically significant positive direct effect on teachers' PU (β = .307, t = 4.769, p = < .001). Thus, H_4 (PEoU has a statistically significant positive direct effect on teachers' PU) is also accepted.

Price Value Predicts Perceived Ease of Use and Perceived Usefulness

Regarding RQ3, PV had a significant positive direct effect on teachers' PEoU (β = .436, t = 6.254, p = < .001) and PU (β = .595, t = 8.618, p = < .001). Hence, H_5 (PV has a statistically significant positive direct effect on teachers' PEoU) is accepted. H_6 (PV has a statistically significant positive direct effect on teachers' PU) is also accepted. PV had a stronger, more significant, more positive direct effect on teachers' PU than on their PEoU. The PV of using PMDs had a more positive effect on teachers' PU and PEoU of mobile devices.

Table 6. SEM Results of Hypothesis Testing (N = 209)

Hypothesis	Path coefficient	Unstandardised estimate	Standardised estimate	t-value (C.R)	P-value	Results
H1	PU →BI (b1)	.583	.715	8.972	***	Accepted
H2	PEoU → BI (b2)	.066	.092	2.055	**	Accepted
H3	PV →BI (a3)	.165	.165	2.675	**	Accepted
H4	PEoU →PU (a1)	.269	.307	4.769	***	Accepted
H5	PV→ PEoU (a2)	.611	.436	6.254	***	Accepted
H6	PV →PU (b3)	.732	.595	8.618	***	Accepted

SE standardised errors, PU = perceived usefulness, PV = price value, PEoU = perceived ease of use, BI = Behavioural Intention; ***p < .001, **p < .05.

The Mediating Role of Perceived Usefulness

Table 7 presents a summary of the mediation analysis. The mediating effects of PU are in paths (a1b1) and (b3b1). The mediating effect of PEoU on PV and BI is in path (a2b2).

Table 7. Mediation Analysis Summary

Hypothesis	Relationship (paths)	Direct effect	Indirect effect	Confidence interval		P-value	Conclusion
				Lower bound	Upper bound		
H7	PEoU→PU→BI (a1b1)	.066	.157	.079	.276	.002	Partial mediation
H8	PV→PU→BI (b3b1)	.165	.427	.286	.618	.002	Partial mediation
H9	PV→PEoU→BI (a2b2)	.165	.040	-.007	.112	.121	Full mediation

Note. PU = perceived usefulness, PV = price value, PEoU = perceived ease of use, BI = behavioural intention; p < .05.

Regarding RQ4, Table 7 shows the significant mediating role of PU on the relationship between PEoU and BI (B = .157, t = 3.413, p = .002 < .05). Thus, H_7 (PU statistically and significantly mediates the effect of PEoU on teachers' BI) is accepted. Relatedly, the results revealed a significant indirect effect of PV on BI through PU (B = .427, t = 5.024, p = .002 < .05). Thus, H_8 (PU statistically and significantly mediates the effect of PV on teachers' BI) is also accepted.

The Mediating Effect of Perceived Ease of Use

Regarding RQ5, Table 7 shows the non-significant mediating role of PEoU on the relationship between PV and BI (B = .40, t =1.333, p = .121 > .05). Therefore, H_9 (PEoU statistically and significantly mediates the effect of PV on teachers' BI) is not accepted.

Discussion

The first objective of this study was to assess the direct effects of PU, PEoU and PV on teachers' BI towards students' learning of mathematics with PMDs through BYOD in school. The second objective was to examine the direct effects of PEoU on PU and PV on PU and PEoU. The third objective was to assess the indirect effects of PEoU and PV on teachers' BI. Five research questions and nine hypotheses guided the study using the three basic TAM factors. We examined the structural abilities of five factors in predicting teachers' BI related to students' learning of mathematics with PMDs through BYOD in school. Overall, the participating teachers showed a positive high BI towards students' learning of mathematics with PMDs in school. This could be attributed to the participating teachers' support for BYOD adoption in Namibian basic education. Consistent with previous studies (Davis, 1989; Livas et al., 2019; Siyam et al., 2022), teachers with positive BI towards a technology are more likely to persevere in their endeavours to integrate that technology into their classroom practices.

In this study, PU predicted teachers' BI with a significantly high beta weight. These findings agree with TAM's original theoretical framework, which states that higher levels of PU lead to higher BI. Our findings echo those of Siyam et al. (2022), who found that PU had a statistically significant positive effect on teachers' BI towards BYOD in the classroom. Similarly, Zhao (2017) reported that PU had a statistically significant positive effect on teachers' BI towards BYOD for English teaching and learning. These findings may serve as a consistent indication that teachers consider students' PMDs to be essential and useful learning tools. However, our findings disagree with those of Mailizar et al. (2021), who found that PU had an insignificant negative effect on teachers' BI towards e-learning use in a mathematics classroom. The results of Mailizar et al. (2021), Siyam et al. (2022), and Zhao (2017) prove the appropriateness of the TAM theoretical framework for BYOD in a school study context. BYOD implementation in school benefits not only the students and the school but also the teachers (Mawere et al., 2022). Thus, if teachers believe that students' use of PMDs to learn mathematics through BYOD in school will make their teaching work easier while producing the desired results, then teachers may consider BYOD useful for education.

Some schools implement BYOD because it can bridge the digital divide, so students have access to PMDs both inside and outside school (Mawere et al., 2022). The digital divide among students is related to their economic status, as some families cannot afford the cost of PMDs, despite their usefulness for learning. In many schools in developing countries, there are inadequate PMDs to cater to all students at the same time, and the few available devices are often used to train students in information communication technology use and not for pedagogical purposes, such as learning mathematics (Mawere et al., 2022). BYOD implementation allows all students access to mobile devices. Students who cannot afford PMDs can use school-owned devices, while those who can afford PMDs are allowed to use them in school. In our study, the costs of PMDs and their availability were examined based on the PV factor. PV had a positive significant effect on BI, making it the second-highest predictor of BI. This finding differs from (Chatterjee et al., 2020), who did not find support for a path between PV and BI. Our results further contradict those of Molina-Castillo et al. (2020), who reported that PV had a negative, insignificant effect on participants' BI. The findings of Molina-Castillo et al. (2020) and Chatterjee et al. (2020) imply that PV is not a significant predictor of BI. The discrepancies in the findings may be attributed to the economic traditions of educational policy and cultural norms regarding the provision of learning materials to students. In some countries, school supplies are traditionally provided by parents, the government, or both. In other countries, teachers may need to request the provision of learning materials from the government or parents. The ease or difficulty of obtaining learning materials can influence how the teachers' PV factor relates to their BI on students' PMDs as learning materials. These economic and cultural factors can influence how participants respond to research questions and approach specific topics, affecting resource availability. Notably, Molina-Castillo et al. (2020) and Chatterjee et al. (2020) did not delve much into these factors in their studies.

Further, the direct effect of PV on PU and PEoU in this study suggests that the participating teachers are willing to facilitate students' learning of mathematics with PMDs through BYOD in school because they consider it useful and easy. However, their PU and PEoU of PMDs for mathematics learning are only valid if the provision of PMDs to students is feasible.

PEoU had a positive, significant impact on teachers' BI in our study. This result is consistent with Zhao (2017), who also reported that PEoU had a significant positive effect on teachers' BI towards BYOD for English teaching and learning in school. As in Zhao's (2017) and Chatterjee et al.'s (2020) studies, the teachers in our study felt that BYOD was useful and easy to use, which resulted in a higher intention to adopt BYOD for mathematics learning. However, our results contradict those of Mailizar et al. (2021), who found that PEoU was a non-significant predictor of teachers' BI towards e-learning use in mathematics teaching.

PEoU was the least significant predictor of teachers' intentions in this study, and its unusually low effect on BI can be attributed to three reasons. First, this study was undertaken during a world crisis, when most schools and teachers in Namibia were dealing with the COVID-19 pandemic and its aftermath. In such times of crisis, lower levels of technology acceptance may be linked to higher levels of BI (Kaisara et al., 2022). Hence, teachers might have found it difficult to recognise how easy it would be for students to learn mathematics with PMDs based on what was happening in schools at that time. Second, teachers might consider students to be heterogeneous, as some students may be more prepared than others to learn using PMDs. Third, the participants could believe that a technology or system is useful while also believing that it is difficult to use (Davis, 1989). In such cases, the performance benefits of adopting BYOD in schools for mathematics might be outweighed by its implementation requirements (Davis, 1989). Additionally, we found that PEoU had a direct effect on PU. This finding is similar to those of Siyam et al. (2022) and further validates the TAM assumption that PEoU is a direct predictor of PU (Davis, 1989).

Based on the mediation results, we drew some conclusions on the mediating roles of PU and PEoU. First, the influence of PEoU on BI flows through PU, confirming the TAM assumption that PEoU indirectly influences BI through PU (Davis, 1989). PU partially mediated the relationship between PEoU and BI. Both the mediated and unmediated paths between PEoU and BI were significant in this study. These findings concur with those of Hur et al. (2015), who found that PEoU indirectly influenced teachers' intentions to use mobile devices for teaching purposes. Partial mediation was also confirmed, as the links between PEoU and PU (the mediator) and the path between PU (the mediator) and BI were all significant in this study. This implies that the participating teachers intend to allow students to learn mathematics with

PMDs in school because they perceived it as both easy and useful. Second, the influence of PV on BI only partially flowed through PU. This suggests that the participants intend to allow students to learn mathematics with PMDs in school if the provision was based on educational stakeholders' perceptions of their usefulness to mathematics learning. Third, the mediating role of PEoU in the relationship between PV and BI was insignificant. Therefore, the effect of PV on BI was significant only in the absence of the mediator (PEoU). This indicates that the participating teachers' intent to allow students to learn mathematics with PMDs in school was based on the availability of PMDs to students but not only when they believed they were easy for students to use.

Conclusion

This study's main outcome is the finding that teachers view students' learning of mathematics with PMDs as useful and easy. Teachers support BYOD implementation at the basic educational levels for mathematics learning with a moderately high BI. This reflects teachers' commitment to facilitating students' learning of mathematics with PMDs through the BYOD policy in school if the devices are made available. However, teachers do not perceive the implementation of BYOD for mathematics learning in schools to be simple. The findings of this study add to TAM's predictive abilities and support its assumption that PU and PEoU are significant direct predictors of BI. Additionally, this study confirms that PEoU is a direct predictor of PU and an indirect predictor of BI through PU. These results further confirm the unified theory of acceptance and use of technology model's assumption that PV predicts BI. This study contributes to the literature by demonstrating the mediating roles of PU and PEoU and the direct effects of PV on PU and PEoU.

The study has practical implications. It is not sufficient that teachers perceive BYOD implementation for mathematics in school learning to be useful if supplying PMDs is a challenge. Difficulties in the supply of mobile devices by parents and the Ministry of Education, Arts and Culture could contribute to teachers' lower PEoU. The Ministry of Education, Arts and Culture should first consider the usefulness of PMDs in mathematics learning and, together with parents, supply PMDs to students. Furthermore, teachers should be trained to facilitate students' learning of mathematics with PMDs so that they will not consider BYOD for mathematics learning to be overly difficult. For student teachers, PMD use in mathematics classrooms can be integrated into the teacher training curriculum. For in-service teachers, such training could be offered as part of ongoing professional development programmes. Finally, the Ministry of Education, Arts and Culture should develop a BYOD policy that fits the Namibian context to help teachers implement BYOD in schools.

Recommendations

The recommendations made herein are in line with the study results and limitations. Future studies should consider how PEoU and PU influence teachers' attitudes and, consequently, their intentions. PEoU in this study had a positive but least effect on intentions. Future studies may examine the efforts and risks that teachers associate with BYOD implementation in schools. The PEoU factor had a few items. Future research may consider increasing the number of items in PEoU to provide a more meaningful explanation of its factor structure. Future studies could examine BYOD acceptance and intentions of other educational stakeholders, such as parents and educational policymakers, to better understand its implementation in schools.

Limitations

The study has both theoretical and practical limitations. Attitude is one of the main determinants of intention. However, this study did not examine teachers' attitudes towards students' learning of mathematics through BYOD in school. Moreover, we found a low PEoU, implying that teachers perceive BYOD for mathematics to be difficult to implement. However, the types of difficulties were not clarified in this study. This study was only limited to Namibian mathematics teachers. Although PEoU was one of the examined TAM main factors and had good Cronbach's alpha and composite reliability in this study, having a few items in it may have limited the full interpretation of the PEoU factor structure in our study results.

Ethics Statement

Permission to undertake this study was granted by the Executive Director of the Ministry of Education, Arts and Culture and the Omusati and Khomas Regional Directors of Education in Namibia. The study was approved by the University of Eastern Finland. All participants provided written informed consent to participate in the study.

Acknowledgements

The authors appreciate the Omusati and Khomas regions' mathematics teachers' time and effort to participate in this study.

Funding

This research is supported by the Global Innovation Network for Teaching and Learning as well as doctoral (early-stage) researcher funding at the University of Eastern Finland.

Authorship Contribution Statement

Jatileni: Concept and design, data acquisition, data analysis and interpretation, manuscript drafting, manuscript critical revision. Havu-Nuutinen: Editing/reviewing, statistical analyses critical revision, supervision. Pöntinen: Editing/reviewing, supervision

References

Aggarwal, D. (2018). Using the technology acceptance model to understand the use of bring your own device (BYOD) to classroom. *Journal on Today's Ideas – Tomorrow's Technologies*, *6*(2), 83–91. https://doi.org/10.15415/jotitt.2018.62007

Alalwan, N., Cheng, L., Al-Samarraie, H., Yousef, R., Ibrahim-Alzahrani, A., & Sarsam, S. M. (2020). Challenges and prospects of virtual reality and augmented reality utilization among primary school teachers: A developing country perspective. *Studies in Educational Evaluation*, *66*, Article 100876. https://doi.org/10.1016/J.STUEDUC.2020.100876

Arifjanova, O. (2022). Byod (bring your own device) technology and mobile learning in teaching languages. *Academic Research in Educational Sciences*, *3*(5), 1102–1105. https://bit.ly/3tPyg8V

Basto, M., & Pereira, J. M. (2012). An SPSS R-menu for ordinal factor analysis. *Journal of Statistical Software*, *46*(4), 1–29. https://doi.org/10.18637/jss.v046.i04

Beneito, P., & Vicente-Chirivella, O. (2020). *Banning mobile phones at schools: Effects on bullying and academic performance* (Working paper No. 04/20). ERI-CES. https://www.erices.es/upload/workingpaper/99_99_0420.pdf

Bower, M., DeWitt, D., & Lai, J. W. M. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, *51*(6), 2215–2233. https://doi.org/10.1111/bjet.13009

Byrne, B. M. (2016). *Structural equation modeling with Amos: Basic concepts, applications, and programming* (3rd ed.). Routledge. https://doi.org/10.4324/9781315757421

Camadan, F., Reisoglu, I., Ursavas, Ö. F., & Mcilroy, D. (2018). How teachers' personality affect on their behavioral intention to use tablet PC. *International Journal of Information and Learning Technology*, *35*(1), 12–28. https://doi.org/10.1108/IJILT-06-2017-0055

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652–661. https://doi.org/10.1177/1744987120927206

Chatterjee, S., Majumdar, D., Misra, S., & Damaševičius, R. (2020). Adoption of mobile applications for teaching-learning process in rural girls' schools in India: An empirical study. *Education and Information Technologies*, *25*, 4057–4076. https://doi.org/10.1007/s10639-020-10168-6

Chuttur, M. (2009). Overview of the technology acceptance model: Origins, developments and future directions. *Sprouts: Working Papers on Information Systems*, *9*(37), 1–23. https://aisel.aisnet.org/sprouts_all/290/

Clark, K. A., Welsh, K. E., Mauchline, A. L., France, D., Whalley, W. B., & Park, J. (2021). Do educators realise the value of bring your own device (BYOD) in fieldwork learning? *Journal of Geography in Higher Education*, *45*(2), 255–278. https://doi.org/10.1080/03098265.2020.1808880

Collier, J. E. (2020). *Applied structural equation modeling using AMOS: Basic to advanced techniques.* Routledge. https://doi.org/10.4324/9781003018414

Courtney, M. G. R. (2013). Determining the number of factors to retain in EFA: Using the SPSS R-Menu v2 0 to make more judicious estimations. *Practical Assessment, Research, and Evaluation*, *18*, Article 8. https://doi.org/10.7275/9cf5-2m72

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly: Management Information Systems*, *13*(3), 319–340. https://doi.org/10.2307/249008

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475–487. https://doi.org/10.1006/imms.1993.1022

Décieux, J. P., Mergener, A., Neufang, M. K., & Sischka, P. (2015). Implementation of the forced answering option within online surveys: Do higher item response rates come at the expense of participation and answer quality? *Psihologija*, *48*(4), 311-326. https://doi.org/10.2298/psi1504311d

Demchenko, O., Bondar, Y., Shykyrynska, O., Komarivska, N., Lyubchak, L., Stakhova, I., & Dabizha, L. (2022). Development of youth's creative abilities schoolchildren by BYOD technology. In *Society. Integration. Education. Proceedings of the International Scientific Conference*, *1* (pp. 341–350). Rezekne Academy of Technologies.

https://doi.org/10.17770/sie2022vol1.6892

Dempsey, S., Lyons, S., & McCoy, S. (2019). Later is better: Mobile phone ownership and child academic development, evidence from a longitudinal study. *Economics of Innovation and New Technology*, *28*(8), 798–815. https://doi.org/10.1080/10438599.2018.1559786

Dogbegah, R., Owusu-Manu, D.-G., & Omoteso, K. (2011). A principal component analysis of project management competencies for the Ghanaian construction industry. *Australasian Journal of Construction Economics and Building*, *11*(1), 26–40. https://doi.org/10.5130/ajceb.v11i1.1680

Doll, W. J., Raghunathan, T. S., Lim, J.-S., & Gupta, Y. P. (1995). A confirmatory factor analysis of the user information satisfaction instrument. *Information Systems Research*, *6*(2), 177-188. https://doi.org/10.1287/isre.6.2.177

Durodolu, O. O. (2016). Technology acceptance model as a predictor of using information system' to acquire information literacy skills. *Library Philosophy and Practice*, *1450*, 1–27. http://digitalcommons.unl.edu/libphilprac/1450

Fabian, K., & Topping, K. J. (2019). Putting "mobile" into mathematics: Results of a randomised controlled trial. *Contemporary Educational Psychology*, *59*, Article 101783. https://doi.org/10.1016/j.cedpsych.2019.101783

French, A. M., Guo, C., Schmidt, M., & Shim, J. P. (2015). *An exploratory study on BYOD in class: Opportunities and concerns* [Paper presentation]. Twenty-first Americas Conference on Information Systems, 2015, Puerto Rico, The United States of America. https://bit.ly/3tTuQC2

Gogtay, N. J., & Thatte, U. M. (2017). Principles of correlation analysis. *Journal of Association of Physicians of India*, *65*, 78-81. https://bit.ly/47azpX3

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572–2593. https://doi.org/10.1111/bjet.12864

Hakami, M. (2020). Using Nearpod as a tool to promote active learning in higher education in a BYOD learning environment. *Journal of Education and Learning*, *9*(1), 119–126. https://doi.org/10.5539/jel.v9n1p119

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, *76*(4), 408–420. https://doi.org/10.1080/03637750903310360

Hoi, V. N., & Mu, G. M. (2021). Perceived teacher support and students' acceptance of mobile-assisted language learning: Evidence from Vietnamese higher education context. *British Journal of Educational Technology*, *52*(2), 879–898. https://doi.org/10.1111/BJET.13044

Hong, J.-C., Tsai, C.-R., & Tai, K.-H. (2023). iSTEAM contest on enhancing self-confidence in making miniature models: Correlate to mastery orientation, engagement and interest. *Research in Science and Technological Education*, *41*(2), 444–461. https://doi.org/10.1080/02635143.2021.1909554

Hur, J. W., Shen, Y. W., Kale, U., & Cullen, T. A. (2015). An exploration of pre-service teachers' intention to use mobile devices for teaching. *International Journal of Mobile and Blended Learning*, *7*(3), 1–17. https://doi.org/10.4018/IJMBL.2015070101

Janmaat, G., McCowan, T., & Rao, N. (2016). Different stakeholders in education. *Compare: A Journal of Comparative and International Education*, *46*(2), 169–171. https://doi.org/10.1080/03057925.2016.1134956

Jarwa, T., Ratnawati, T., & Nugroho, M. (2021). Tax compliance modeling regarding individual characteristics, information technology knowledge and sanctions on taxpayer awareness, ability, willingness and compliance as impacts of the development of the central business district of Surabaya city. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *18*(7), 98–109. https://archives.palarch.nl/index.php/jae/article/view/7598

Johnson, N. F. (2019). Dysfunctional devices in the classroom meet the habitus of the new. *E-Learning and Digital Media*, *16*(3), 208–220. https://doi.org/10.1177/2042753019831385

Kaisara, G., Atiku, S. O., & Bwalya, K. J. (2022). Structural determinants of mobile learning acceptance among undergraduates in higher educational institutions. *Sustainability*, *14*(21), Article 13934. https://doi.org/10.3390/su142113934

Keane, T., & Keane, W. F. (2022). The missing link: The parental voice in bring your own device (BYOD) programs. *Education and Information Technologies*, *27*, 7699–7719. https://doi.org/10.1007/s10639-022-10902-2

Koçak, Ö., & Göksu, İ. (2023). Engagement of Higher Education Students in Live Online Classes: Scale Development and Validation. *TechTrends*, *67*, 534–549. https://doi.org/10.1007/s11528-023-00849-7

Li, N., Huang, J., & Feng, Y. (2020). Construction and confirmatory factor analysis of the core cognitive ability index system of ship C^2 system operators. *PLoS ONE*, *15*(8), Article e0237339. https://doi.org/10.1371/journal.pone.0237339

Liu, X., Luo, Y., Liu, Z.-Z., Yang, Y., Liu, J., & Jia, C.-X. (2020). Prolonged mobile phone use is associated with poor academic performance in adolescents. *Cyberpsychology, Behavior, and Social Networking*, *23*(5), 303–311. https://doi.org/10.1089/CYBER.2019.0591

Livas, C., Katsanakis, I., & Vayia, E. (2019). Perceived impact of BYOD initiatives on post-secondary students' learning, behaviour and wellbeing: The perspective of educators in Greece. *Education and Information Technologies*, *24*, 489–508. https://doi.org/10.1007/s10639-018-9791-6

Lowe, N. K. (2019). What is a pilot study? *JOGNN – Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *48*(2), 117–118. https://doi.org/10.1016/j.jogn.2019.01.005

Mailizar, M., Almanthari, A., & Maulina, S. (2021). Examining teachers' behavioral intention to use e-learning in teaching of mathematics: An extended tam model. *Contemporary Educational Technology*, *13*(2), Article ep298. https://doi.org/10.30935/CEDTECH/9709

Masilo, G. M., Simelane-Mnisi, S., Mji, A., & Mokgobu, I. (2021). Students' behavioural intention and challenges to bring your own device (BYOD) in higher education during COVID-19 and beyond. *World Transactions on Engineering and Technology Education*, *19*(1), 10–15. https://bit.ly/3SrA2am

Mawere, T., Manjeese, C., & Chigada, J. (2022). Secondary school teachers' perceptions of BYOD among learners within the classroom email: Article history. *South African Computer Journal*, *34*(1), 79–102. https://bit.ly/3G1ODSF

McCord, M. (2007). Technology acceptance model. In D. Marikyan & S. Papagiannidis (Eds.), *Handbook of research on electronic surveys and measurements* (pp. 306–308). IGI Global. https://doi.org/10.4018/978-1-59140-792-8.ch038

Ministry of Education, Arts and Culture Republic of Namibia. (2022). *Education management information system (EMIS).* https://bit.ly/3s3OOK0

Molina-Castillo, F.-J., Lopez-Nicolas, C., & de Reuver, M. (2020). Mobile payment: The hiding impact of learning costs on user intentions. *Journal of Theoretical and Applied Electronic Commerce Research*, *15*(1), 1–12. https://doi.org/10.4067/S0718-18762020000100102

Mozelius, P., Jaldemark, J., Eriksson Bergström, S., & Sundgren, M. (2020). The concept of 'bringing your own device' in scaffolded and augmented education. In V. Geroimenko (Ed.), *Augmented reality in education: A new technology for teaching and learning* (pp. 59–70). Springer. https://doi.org/10.1007/978-3-030-42156-4_4

Nuhoğlu Kibar, P., Gündüz, A. Y., & Akkoyunlu, B. (2020). Implementing bring your own device (BYOD) model in flipped learning: Advantages and challenges. *Technology, Knowledge and Learning*, *25*, 465–478. https://doi.org/10.1007/s10758-019-09427-4

Osakwe, J., Dlodlo, N., & Jere, N. (2017). Where learners' and teachers' perceptions on mobile learning meet: A case of Namibian secondary schools in the Khomas region. *Technology in Society*, *49*, 16–30. https://doi.org/10.1016/j.techsoc.2016.12.004

Owan, V. J., Chuktu, O., Mbon, U. F., Denwigwe, C. P., Okpechi, P. A., Arop, L. O., Ekere, S. C., Udida, U. J., Asuquo, M. E., & Akpa, S. U. (2022). Perspectives of Nigerian graduates on curriculum reengineering, acquisition of emerging technologies, and job creation: A descriptive study. *Journal of Curriculum and Teaching, 11*(8), 224-237. https://doi.org/10.5430/jct.v11n8p224

Page Jeffery, C. (2022). 'It's just another nightmare to manage': Australian parents' perspectives on BYOD and 'ed-tech' at school and at home. *Learning, Media and Technology*, *47*(4), 471–484. https://doi.org/10.1080/17439884.2021.2022691

Parsons, D., & Adhikari, J. (2016). Bring your own device to secondary school: The perceptions of teachers, students and parents. *Electronic Journal of E-Learning*, *14*(1), 66–80.

Piedmont, R. L. (2014). Inter-item correlations. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 3303–3304). https://doi.org/10.1007/978-94-007-0753-5_1493

Poláková, P., & Klímová, B. (2019). Mobile technology and generation Z in the English language classroom—A preliminary study. *Education Sciences*, *9*(3), Article 203. https://doi.org/10.3390/EDUCSCI9030203

Qin, A., Hu, F., Qin, W., Dong, Y., Li, M., & Xu, L. (2023). Educational degree differences in the association between work stress and depression among Chinese healthcare workers: Job satisfaction and sleep quality as the mediators. *Frontiers in Public Health*, *11*, Article 1138380. https://doi.org/10.3389/fpubh.2023.1138380

Rudyanto, H., Marsigit, M., Wangid, M. N., & Gembong, S. (2019). The use of bring your own device-based learning to measure student algebraic thinking ability. *International Journals of Emerging Technologies in Learning*, *14*(23), 233–241. https://doi.org/10.3991/ijet.v14i23.11050

Saidu, M. K., & Al Mamun, M. A. (2022). Exploring the factors affecting behavioural intention to use Google Classroom: University teachers' perspectives in Bangladesh and Nigeria. *TechTrends*, *66*, 681–696.

https://doi.org/10.1007/s11528-022-00704-1

Salloum, S. A., Qasim Mohammad Alhamad, A., Al-Emran, M., Abdel Monem, A., & Shaalan, K. (2019). Exploring students' acceptance of e-learning through the development of a comprehensive technology acceptance model. *IEEE Access*, *7*, 128445–128462. https://doi.org/10.1109/ACCESS.2019.2939467

Sánchez, S. P., López-Belmonte, J., Moreno-Guerrero, A.-J., Sola Reche, J. M., & Cabrera, A. F. (2020). Effect of bring-your-own-device program on flipped learning in higher education students. *Sustainability*, *12*(9), Article 3729. https://doi.org/10.3390/su12093729

Siyam, N., Hussain, M., & Alqaryouti, O. (2022). Factors impacting teachers' acceptance and use of bring your own device (BYOD) in the classroom. *SN Social Sciences*, *2*, Article 8. https://doi.org/10.1007/s43545-021-00307-2

Strickland, O. L. (2003). Using factor analysis for validity assessment: Practical considerations. *Journal of Nursing Measurement*, *11*(3), 203–205. https://doi.org/10.1891/jnum.11.3.203.61274

Suprianto, A., Ahmadi, F., & Suminar, T. (2019). The development of mathematics mobile learning media to improve students' autonomous and learning outcomes. *Journal of Primary Education*, *8*(1), 84–91. https://bit.ly/3RaVBLH

Tegor, T., Thasimmim, S. N., Dianasari, E. L., & Yusmalina, Y. (2023). The influence of work discipline in mediating work environment relationships on job satisfaction. *Jurnal Cafetaria*, *4*(1), 106–112. https://bit.ly/3SIvm0c

Tinmaz, H., & Lee, J. H. (2019). A perceptional analysis of BYOD (bring your own device) for educational or workplace implementations in a South Korean case. *Participatory Educational Research*, *6*(2), 51–64. https://doi.org/10.17275/per.19.12.6.2

Tsui, M. Y., & Mok, I. A. C. (2019). Exploring BYOD scheme from a socialcultural perspective. *ICERI2019 Proceedings*, *1*, 2947–2957. https://doi.org/10.21125/iceri.2019.0751

Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 169-332. https://doi.org/10.1287/MNSC.46.2.186.11926

Xu, S., & Zhu, S. (2020). Factors influencing K-12 teachers' intention to adopt mobile devices in teaching. *Computers in the Schools*, *37*(4), 292–309. https://doi.org/10.1080/07380569.2020.1830257

Zhao, J. (2017). Factors influence EFL teacher's adoption of BYOD. In (Ed.) *DEStech Transactions on Social Science, Education and Human Science*, *Mess* (pp.149–156). DEStech Publications. https://doi.org/10.12783/dtssehs/mess2017/12104

Zong, T., Wang, F., Wei, X., & Liu, Y. (2023). Mechanisms influencing learning gains under information security: Structural equation modeling with mediating effect. *Intelligent Automation and Soft Computing*, *36*(3), 3447–3468. https://doi.org/10.32604/iasc.2023.035456