

RESEARCH ARTICLE

Expected Performance, Habit, and Enjoyment as Key Factors Influencing Teachers' Intentions to Use Personal Learning Environments for Educational Purposes

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Abstract: Recent research emphasizes the importance of Personal Learning Environments (PLEs) in the educational process. However, before their integration into school classrooms, it is important to investigate the extent to which teachers accept PLEs for educational purposes—an area that has received limited attention in the existing literature. To this end, this study empirically investigates teachers' intention to use and Use Behavior of PLEs. Drawing on the UTAUT2 model, data from 540 Greek primary and secondary school teachers were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings showed that Performance Expectancy, Habit, and Hedonic Motivation were significantly associated with Behavioral Intention, while Behavioral Intention, Habit, and Facilitating Conditions were significantly associated with Use Behavior. Mediation analysis further showed significant indirect effects of Performance Expectancy, Hedonic Motivation, and Habit on Use Behavior through Behavioral Intention. Behavioral Intention partially mediated the relationship between Habit and Use Behavior, indicating complementary partial mediation. No significant moderating effects of gender, age, or classroom technology-integration experience were found. The findings offer further insight into the mechanisms underlying teachers' use of PLEs and inform their integration into educational practice.

Keywords: ICT integration, e-me, e-learning, teachers' professional development program

1 Introduction

Traditional e-learning environments, such as Learning Management Systems (LMS) or Moodle, primarily focus on course design, serving the needs of instructors but often falling short of adequately accommodating students' preferences (Benhamdi et al., 2017). To address this one-way focus, recent research (Elfeky, 2019) has shifted its attention to Personal Learning Environments (PLEs), which primarily cater to personal learning needs (Benhamdi et al., 2017; Tzavara et al., 2023). Moreover, experimental data supports the idea that PLEs enhance participants' high-level skills more than conventional classroom learning environments (Elfeky, 2019).

To cater to learners' needs, however, Ertmer et al. (2012) stress that integrating digital technology into the curriculum relies on teachers' willingness to embrace the technology. As such, investigating the acceptance model of technology, such as PLEs, by teachers for educational purposes can foster a supportive environment for their integration into education. Empirical data can address concerns and inform stakeholders about digital solutions in teaching and learning (Nikolopoulou et al., 2021; Teo, 2010). Furthermore, understanding the factors that influence teachers' intentions and beliefs about e-learning could aid system creators in designing environments that encourage their adoption by teachers for educational use (Del Barrio-García et al., 2015). Nevertheless, despite the importance of examining factors that could explain teachers' intention to use PLEs, a systematic literature review by Serhan and Yahaya (2022), encompassing works published from 2000 to 2020, revealed that only 8% of empirical research looking at various features of PLEs involved teachers. In line with the above finding, only several studies have investigated teachers' intention to use PLEs (Pynoo et al., 2011) or similar systems, e.g., virtual learning environments (Gunasinghe et al., 2020; Raman & Rathakrishnan, 2018). In this direction, most studies primarily examine students' acceptance of e-learning systems (Yee & Abdullah, 2021).

In this study, we aim to bridge this gap by using the Unified Theory of Acceptance and Use of Technology – UTAUT 2 (Venkatesh et al., 2012) model to investigate Greek teachers' intention to use a PLE, specifically the digital platform e-me, which was extensively used by the Greek teacher community during the pandemic (Tzavara et al., 2023).

1.1 The Personal Learning Environment

This paper defines a PLE as a structured digital platform in which specific or non-specific learning support applications coexist (Attwell, 2007; Torres Kompen et al., 2019). More specifically, PLEs encompass tools, resources, web links, activities, and learning communities that learners can use to guide their learning process and set up their learning aims. They offer learners personalized spaces for developing, sharing, monitoring, and evaluating their learning experiences, irrespective of when and where they choose to do so (Attwell, 2007; Tzavara et al., 2023). Consequently, and eased by ICT, PLEs integrate various approaches that support learning in both formal and non-formal education.

Teacher endorsement of PLEs is significant as they motivate students to assume ownership and control of their learning process, fostering autonomy and guiding them toward their goals (Nan Cenka et al., 2022; Shaikh & Khoja, 2012). In such an environment, the teacher-student relationship is more egalitarian, promoting a student-centred approach (Shaikh & Khoja, 2012). PLEs, in this context, ease self-regulated learning, where students construct knowledge with the support of experienced peers and teachers (Attwell, 2007; Drolia et al., 2020; Nan Cenka et al., 2022).

One notable PLE that saw extensive use within the Greek educational community and by students of all levels during the pandemic is the digital educational platform e-me (<https://e-me.edu.gr>) (Tzavara et al., 2023). Students and teachers could access e-me anywhere and anytime using internet connectivity devices. The platform is available in three versions: the official e-me, accessible only through Panhellenic School Network accounts; the e-me for everyone (4all.e-me.edu.gr); and the multilingual European e-me (e-me4all.eu) (See Figure 1).

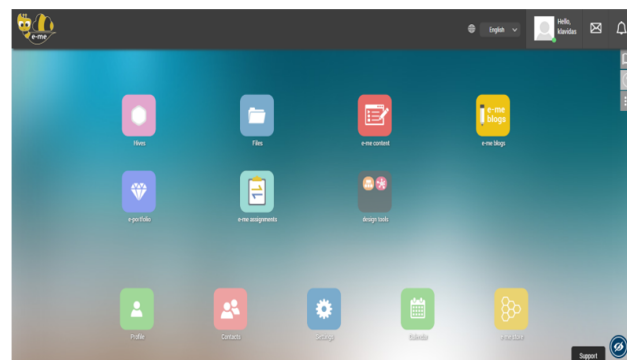


Figure 1 DUser interface of e-me for all (<https://e-me4all.eu/>)

In the e-me platform, users can search for and add contacts, create collaboration spaces (cells), engage in real-time video calls and message other members, create and assign tasks to cell members, plan and communicate through personal blogs, organize and showcase students' work, develop interactive learning materials, and much more. It also offers access to the Panhellenic Repository of Learning Objects "Photodentro LOR" and the e-books Repository, as well as various other tools (Tzavara et al., 2023).

1.2 Technology acceptance model of PLEs

This research examines the factors that contribute to the acceptance of Personal Learning Environments (PLEs) by Greek primary and secondary teachers using the UTAUT 2 model. The UTAUT (Unified Theory of Acceptance and Use of Technology) is a technology acceptance model that integrates previous models, including TAM (Technology Acceptance Model) (Davis, 1989; Davis et al., 1989), by aligning their constructs into the critical constructs of UTAUT (Venkatesh et al., 2003). This original version comprises six fundamental constructs: Performance Expectancy (P.E.), Effort Expectancy (E.E.), Social Influence (S.I.), Facilitating Conditions (F.C.), Behavioral Intention (B.I.), and Use Behavior (USE), along with four moderating variables: Gender, Age, Experience with Technology, and Voluntariness of Use. The subsequent and more comprehensive UTAUT2 includes three additional independent constructs: Habit (H.T.), Hedonic Motivation (H.M.), and Price Value (P.V.) while incorporating user

characteristics (age, gender, and technology experience) as moderating variables among the independent variables that may affect both intention and actual use of technology (Venkatesh et al., 2012).

The UTAUT 2 was chosen in this study for its robustness, as it has proved satisfactory performance in structuring its components and addressing falsifiability issues (Venkatesh et al., 2016). According to its authors, studying the post-adoption use scenarios of a technology is recommended, and such was the case in the present research. It is worth noting that the participating teachers in this study showed that they had used PLEs during the pandemic. Our review of the relevant literature detected limited empirical studies on teachers' acceptance of PLEs using the UTAUT model. For example, Pynoo et al. (2011) used the UTAUT model on a teacher sample, Gunasinghe et al. (2020) on students, and other theoretical models such as those used by Del Barrio-García et al. (2015) and Rejón-Guardia et al. (2019) are also worth noting.

More specifically, Pynoo et al. (2011) conducted a longitudinal study on the acceptance of a digital learning environment using the UTAUT among secondary school teachers in German-speaking schools in Belgium. They found that the main predictors of environmental acceptance were PE and S.I., while E.E. and F.C. had a minor impact. In a student sample and qualitative study by Gunasinghe et al. (2020) involving 20 Chinese undergraduates, similar factors explained PLE acceptance. In a study of Spanish students from a marketing department, Rejón-Guardia et al. (2019) applied the TAM to explore the intention to use a Google application-based PLE. They found perceived usefulness and ease of use, along with S.I., to explain students' intention to use the platform. Del Barrio-García et al. (2015) studied Spanish students in an economics department using an extended TAM model. They found that satisfaction with the PLE and primary TAM factors such as perceived usefulness and ease of use explained students' intention to use the platform.

By expanding our literature review to e-learning environments that share characteristics with PLEs, we can gain added insights into the factors affecting teachers' intention to use PLEs. For instance, Raman and Rathakrishnan (2018) applied the UTAUT methodology to assess the acceptance of Virtual Learning Environment (VLE) systems among Malaysian secondary teachers, identifying P.E., F.C., and S.I. as significant factors. Similarly, Gunasinghe et al. (2020) used the UTAUT3 to explain the acceptance of VLE systems among academics from Sri Lankan public universities, finding P.E., E.E., F.C., H.T., and H.M. to be significant factors, while S.I. and Personal Innovation (P.I.) were not significant. In the context of mobile learning, Nikolopoulou et al. (2021) used the UTAUT2 to identify factors influencing the use of mobile devices in education among Greek primary and secondary school teachers, highlighting the significance of H.T., H.M., and P.E. in predicting teachers' intention to use mobile devices.

Finally, Kim and Lee (2020) administered the UTAUT model to 305 secondary teachers in the Philippines. They found P.E., E.E., SI, and educational policy as significant factors influencing teachers' behavioral intention to use ICT in education. They also found that B.I., H.T., and F.C. positively associate with the actual use of ICT in education.

1.3 Conceptual model

In the context of our PLE acceptance model using the UTAUT 2 (Nikolopoulou et al., 2021; Venkatesh et al., 2012), B.I. corresponds to the degree to which the interviewed teachers believe they would use PLEs for educational purposes and is expected to relate to USE (Kim & Lee, 2020). USE measures the extent to which teachers employ PLEs for educational purposes. P.E. reflects the extent to which teachers believe that using PLEs will help them achieve their teaching goals and enhance their performance and is expected to be related to B.I. (Gunasinghe et al., 2020; Kim & Lee, 2020; Pynoo et al., 2011; Raman & Rathakrishnan, 2018). E.E. reflects the ease of use associated with PLEs and is expected to be associated with B.I. (Gunasinghe et al., 2020; Kim & Lee, 2020; Pynoo et al., 2011). S.I. measures the degree of influence teachers' beliefs about PLEs have on others (e.g., friends, colleagues, etc.) and is expected to be related to B.I. (Kim & Lee, 2020; Pynoo et al., 2011; Raman & Rathakrishnan, 2018). F.C.s measure the extent to which respondents believe there is sufficient organizational and technical infrastructure to support PLE use in the classroom and is expected to be linked to B.I. (Gunasinghe et al., 2020; Pynoo et al., 2011; Raman & Rathakrishnan, 2018) and USE (Kim & Lee, 2020). H.M. assesses the enjoyment teachers derive from using PLEs in teaching and is expected to be associated with B.I. (Gunasinghe et al., 2020). H.T. reflects how teachers believe using PLEs becomes a habit and is expected to be linked to B.I. (Gunasinghe et al., 2020) and USE (Kim & Lee, 2020). Technology Perceived Value (P.V.) reflects the degree to which teachers believe that PLEs are "worth the money" and are expected to be associated with

B.I. (Venkatesh et al., 2012). Lastly, moderating variables such as teachers' gender, age, and experience with technology integration in the classroom explain the effects above (Venkatesh et al., 2012). In addition to direct relationships, the present study examines whether Behavioral Intention mediates the relationships between the UTAUT2 antecedents and Use Behavior.

1.4 Research Hypotheses

Using the UTAUT2 model, we examined the structural relationships among the nine latent variables. The twelve hypotheses tested in our study concern the direct effects presented in Figure 2, the indirect effects of the UTAUT2 antecedents on Use Behavior through Behavioral Intention, and the moderating effects of gender, age, and classroom technology-integration experience. Specifically, these cases are:

- (1) H1: Expected Performance positively affects teachers' Intention to use PLEs in their teaching.
- (2) H2: Expected effort positively affects teachers' Intention to use PLEs in their teaching.
- (3) H3: Social Influence positively affects teachers' Intention to use PLEs in their teaching.
- (4) H4: Facilitating Conditions positively affect teachers' Intention to use PLEs in their teaching.
- (5) H5: Hedonic Motivation positively affects teachers' Intention to use PLEs in their teaching.
- (6) H6: Perceived value positively affects teachers' Intention to use PLEs in their teaching.
- (7) H7: Habit positively affects teachers' intention to use PLEs in their teaching.
- (8) H8: There is a positive effect of Intention to Use on the use of PLEs by teachers.
- (9) H9: Facilitating conditions positively affects teachers' use of PLEs.
- (10) H10: Habit positively affects teachers' use of PLEs.
- (11) H11: There is a moderate effect of gender, age, and experience on integrating technology in the classroom.
- (12) H12: Behavioral Intention mediates the relationships between the UTAUT2 antecedents (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit) and teachers' Use Behavior of PLEs.

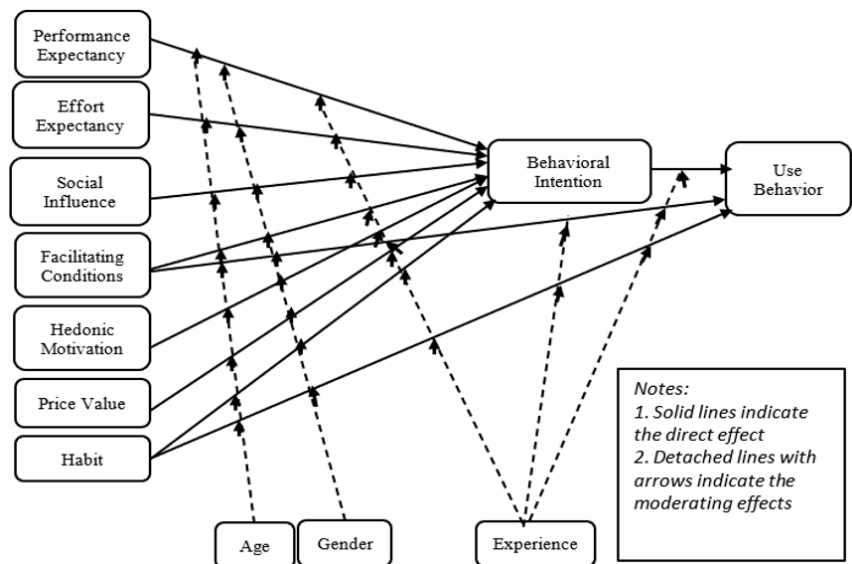


Figure 2 Conceptual UTAUT2 model shows the hypothesized direct, indirect, and moderating effects. (Unified Theory of Acceptance and Use of Technology – UTAUT2)

2 Research Methodology

The research study was conducted in May and June 2021, marking the conclusion of the 2021-2022 school year and occurring two months after the resumption of in-classroom learning. It was approved by the Institutional Review Board of the Department of Educational Science and Early Childhood Education at the University of Patras. This cross-sectional study adopted a quantitative research design (Creswell, 2012), with data collected through an online ques-

tionnaire administered following the guidelines of [Lavidas et al. \(2022b\)](#). The questionnaire initially listed the study's aims, instructions for completion, assurances about the anonymity of respondents, and a question inquiring about their prior experience with the e-me platform. Respondents who indicated having experience with the specific platform were directed to answer the subsequent questions in the questionnaire.

2.1 Research instrument

The questions of the questionnaire were divided into two sections. The first section collected information about participants' demographics, including gender, age, level of education, and whether the teachers had used e-me for educational purposes (experience with e-me: yes or no). The second section included thirty-two statements to which respondents could respond using a five-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These statements were adapted from the corresponding questionnaire used in the research by [Nikolopoulou et al. \(2021\)](#), who, using the UTAUT2 model, investigated the factors influencing the utilization of mobile devices in education among Greek primary and secondary teachers. Specifically, the only adjustment involved replacing the term "mobile devices" with "e-me digital platform" (see the work of [Nikolopoulou et al. \(2021\)](#)). It is worth noting that the psychometric properties of [Nikolopoulou et al. \(2021\)](#) research instrument have been established with a Greek sample. Next, the psychometric properties of this instrument with the sample of this work are presented and analyzed in the results section.

2.2 Participants

The questionnaire was distributed to the email addresses of three hundred schools, forming 150 primary and 150 secondary schools in various regions of Greece. In total, we estimate that 4,500 teachers received this invitation. This research's corresponding convenience sample included 540 volunteer teachers who confirmed having experience with PLE (e-me). [Table 1](#) provides a detailed presentation of the demographic characteristics of the 540 participating teachers in the study.

Table 1 Demographic characteristics of participating teachers (N = 540)

Variable	Frequency	Relative frequency (%)
Sex		
Male	121	22.4
Female	417	77.2
Other	2	0.4
Age (years)		
≤ 35	27	5.0
36–40	52	9.6
41–45	80	14.8
46–50	118	21.9
51–55	181	33.5
≥ 56	82	15.2
Use of e-me for educational purposes		
No	109	20.2
Yes	431	79.8
Teaching level		
Primary school	293	54.3
Secondary school	247	45.7

2.3 Data analysis strategy

The R environment ([R Core Team, 2023](#)), together with the psych ([Revelle, 2023](#)) and plspm packages ([Sanchez et al., 2025](#)), was used to analyze the data. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to assess both measurement and structural models. The measurement model was evaluated in terms of indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. Cronbach's alpha and composite reliability were used to assess internal consistency reliability, while average variance extracted (AVE) was examined to assess convergent validity. Discriminant validity was evaluated using the heterotrait-monotrait ratio (HTMT). The structural model was evaluated by examining the estimated path coefficients and the explained variance (R^2) of the endogenous constructs. Bootstrapping with 2,000 resamples was used to estimate 95% confidence intervals for the model parameters and to assess the statistical significance of the hypothesized relationships. A relationship was considered statistically significant when its corresponding 95% bootstrap

confidence interval did not include zero. In addition, mediation analysis was conducted to examine whether Behavioral Intention mediated the relationships (Nitzl et al., 2016) between the UTAUT2 antecedents—Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Perceived Value, and Habit—and Use Behavior. Specific indirect effects were assessed using bootstrapping and were considered statistically significant when the corresponding 95% bootstrap confidence interval did not include zero. Finally, potential common method bias was also assessed using the full-collinearity VIF approach. Each latent construct was regressed on all remaining constructs, and the resulting VIF values were evaluated against the conservative threshold of 3.3 proposed by Kock (2015).

3 Results

3.1 Validity and reliability of the measurement tool

The analysis showed that the nine subscales used exhibit satisfactory reliability and convergent validity, as presented in Table 2. Specifically, we observed satisfactory values for both Cronbach's Alpha and Composite Reliability, which exceed 0.7. Additionally, we observed satisfactory convergent validity, as shown by the constructs having an average extracted variance (AVE) greater than 0.5. Furthermore, all statements displayed favorable loadings within their respective subscales (Loadings > 0.7) (Hair et al., 2017).

Table 2 Descriptive statistics for the primary constructs corresponding to the nine subscales, along with reliability and validity indices of the subscales

Variable	Mean (S.D.)	Factor Loadings	Cronbach's Alpha	Composite Reliability (C.R.)	Average Variance Extracted (AVE)
Use Behavior (USE)	2.87(1.09)		0.867	0.910	0.718
USE1		0.894			
USE2		0.840			
USE3		0.919			
USE4		0.721			
Behavioral Intention (B.I.)	2.96(1.24)		0.958	0.973	0.923
BI1		0.964			
BI2		0.949			
BI3		0.968			
Performance Expectancy (P.E.)	3.20(1.08)		0.941	0.958	0.849
PE1		0.906			
PE2		0.948			
PE3		0.905			
PE4		0.927			
Effort Expectancy (E.E.)	3.61(1.03)		0.935	0.953	0.837
EE1		0.901			
EE2		0.918			
EE3		0.938			
EE4		0.902			
Social Influence (S.I.)	2.62(1.12)		0.937	0.960	0.888
SI1		0.929			
SI2		0.964			
SI3		0.934			
Facilitating Conditions (F.C.)	3.70 (.86)		0.802	0.869	0.624
FC1		0.797			
FC2		0.758			
FC3		0.862			
FC4		0.738			
Hedonic Motivation (H.M.)	3.49(1.17)		0.968	0.979	0.939
HM1		0.974			
HM2		0.970			
HM3		0.964			
Price Value (P.V.)	3.03(1.13)		0.912	0.945	0.851
PV1		0.885			
PV2		0.952			
PV3		0.928			
Habit (H.T.)	2.27(1.02)		0.876	0.915	0.729
HT1		0.865			
HT2		0.830			
HT3		0.815			
HT4		0.902			

Furthermore, as seen in Table 3, all correlations between constructs are statistically significant and range from “moderate” to “large” effect sizes (Cohen, 1977). Finally, calculating 95% confidence intervals for the heterotrait-monotrait ratio (HTMT) of all correlations across all constructs does not exceed unity, showing satisfactory discriminant validity (Henseler et al., 2014).

Table 3 Product moment Pearson’s linear correlation coefficients for the nine underlying constructs correspond to the nine subscales of the UTAUT2

	1	2	3	4	5	6	7	8	9
1. USE	1								
2. B.I.	0.847 **	1							
3. PE	0.767 **	0.771 **	1						
4. E.E.	0.534 **	0.487 **	0.484 **	1					
5. S.I.	0.636 **	0.637 **	0.670 **	0.422 **	1				
6. F.C.	0.562 **	0.536 **	0.545 **	0.727 **	0.481 **	1			
7. H.M.	0.736 **	0.729 **	0.753 **	0.579 **	0.586 **	0.623 **	1		
8. P.V.	0.516 **	0.529 **	0.518 **	0.389 **	0.463 **	0.454 **	0.549 **	1	
9. H.T.	0.799 **	0.799 **	0.679 **	0.504 **	0.659 **	0.509 **	0.638 **	0.545 **	1

Note: ** Correlation is significant at the 0.01 level (2-tailed)

3.2 Assessment of common method bias

The full-collinearity assessment yielded VIF values ranging from 1.63 to 5.18. The VIF values for USE (5.18), BI (4.95), HT (3.60), and PE (3.51) exceeded the conservative threshold of 3.3, whereas those for EE (2.34), SI (2.15), FC (2.64), HM (3.28), and PV (1.63) remained below this threshold. So, common method bias cannot be completely ruled out based on the full-collinearity VIF criterion. However, these elevated VIF values should not be interpreted as definitive evidence of common method bias, as they may partly reflect strong substantive associations among theoretically related constructs.

3.3 Evaluation of the conceptual model of the research

Based on the structural model analysis, six of the ten direct-effect hypotheses were supported, as shown in Table 4. The corresponding path coefficients were statistically significant, as their 95% bootstrap confidence intervals did not include zero. Performance Expectancy, Hedonic Motivation, and Habit were significantly associated with Behavioral Intention, while Behavioral Intention, Facilitating Conditions, and Habit were significantly associated with Use Behavior. The model explained 75.4% of the variance in Behavioral Intention ($R^2 = 0.754$) and 78.3% of the variance in Use Behavior ($R^2 = 0.783$). Finally, the examination of the moderating effects of gender, age, and classroom technology-integration experience did not reveal any statistically significant interaction effects.

Table 4 Assessing the hypotheses of the conceptual model: Path coefficients (β) and their 95% bootstrap confidence intervals based on 2,000 resamples

Hypothesis	Path	β	95% CI Lower	95% CI Upper	Result
H1	P.E. $\rightarrow$ B.I.	0.291	0.211	0.375	Supported
H2	E.E. $\rightarrow$ B.I.	-0.041	-0.107	0.028	Not supported
H3	S.I. $\rightarrow$ B.I.	0.015	-0.048	0.082	Not supported
H4	F.C. $\rightarrow$ B.I.	0.038	-0.037	0.109	Not supported
H5	H.M. $\rightarrow$ B.I.	0.202	0.118	0.285	Supported
H6	P.V. $\rightarrow$ B.I.	0.007	-0.050	0.067	Not supported
H7	H.T. $\rightarrow$ B.I.	0.459	0.394	0.521	Supported
H8	B.I. $\rightarrow$ USE	0.561	0.483	0.635	Supported
H9	F.C. $\rightarrow$ USE	0.134	0.083	0.186	Supported
H10	H.T. $\rightarrow$ USE	0.278	0.210	0.350	Supported

Note: Performance Expectancy (P.E.), Effort Expectancy (E.E.), Social Influence (S.I.), Facilitating Conditions (F.C.), Hedonic Motivation (H.M.), Price Value (P.V.), Habit (H.T.), Behavioral Intention (B.I.), and Use Behavior (USE). A path was considered statistically significant when its 95% bootstrap confidence interval did not include zero. B.I. ($R^2 = 0.754$, adjusted $R^2 = 0.751$), USE ($R^2 = 0.783$, adjusted $R^2 = 0.782$)

3.4 Mediation analysis

Mediation analysis was conducted to examine whether Behavioral Intention mediated the relationships between the UTAUT2 antecedents and Use Behavior. As shown in Table 5,

Performance Expectancy had a significant positive indirect effect on Use Behavior through Behavioral Intention ($\beta = 0.163$, 95% CI [0.112, 0.220]). Hedonic Motivation also showed a significant indirect effect on Use Behavior through Behavioral Intention ($\beta = 0.114$, 95% CI [0.065, 0.165]), as did Habit ($\beta = 0.258$, 95% CI [0.212, 0.306]). In contrast, the indirect effects of Effort Expectancy, Social Influence, Facilitating Conditions, and Perceived Value were not statistically significant, as their 95% bootstrap confidence intervals included zero.

Table 5 Indirect effects of the UTAUT2 antecedents on Use Behavior through Behavioral Intention

Hypothesis	Indirect path	β	Bootstrap SE	95% CI	Result
H12a	P.E. $\rightarrow$ B.I. $\rightarrow$ USE	0.163	0.028	[0.112, 0.220]	Supported
H12b	E.E. $\rightarrow$ B.I. $\rightarrow$ USE	-0.023	0.019	[-0.060, 0.015]	Not supported
H12c	S.I. $\rightarrow$ B.I. $\rightarrow$ USE	0.009	0.019	[-0.027, 0.045]	Not supported
H12d	F.C. $\rightarrow$ B.I. $\rightarrow$ USE	0.022	0.021	[-0.020, 0.061]	Not supported
H12e	H.M. $\rightarrow$ B.I. $\rightarrow$ USE	0.114	0.026	[0.065, 0.165]	Supported
H12f	P.V. $\rightarrow$ B.I. $\rightarrow$ USE	0.004	0.017	[-0.027, 0.038]	Not supported
H12g	H.T. $\rightarrow$ B.I. $\rightarrow$ USE	0.258	0.024	[0.212, 0.306]	Supported

Note: P.E. = Performance Expectancy; E.E. = Effort Expectancy; S.I. = Social Influence; F.C. = Facilitating Conditions; H.M. = Hedonic Motivation; P.V. = Perceived Value; H.T. = Habit; B.I. = Behavioral Intention; USE = Use Behavior. Indirect effects were evaluated using 2,000 bootstrap resamples. An indirect effect was considered statistically significant when its 95% bootstrap confidence interval did not include zero.

The mediation analysis further highlights the significant role of Habit in teachers' use of PLEs. Behavioral Intention partially mediated the relationship between Habit and Use Behavior, while Habit also kept a significant direct relationship with Use Behavior. This finding suggests that Habit is associated with PLE use through two complementary pathways: indirectly, by strengthening teachers' intention to use PLEs, and directly, through habitual patterns of technology use.

4 Discussion

The data analysis revealed that the UTAUT 2 technology acceptance model provides insights into the factors that explain teachers' intention to use and actual use of PLEs, focusing on the e-me platform (Tzavara et al., 2023). The analysis confirmed the robustness of the UTAUT 2 model and its adaptability to data concerning factors influencing Greek teachers' intention to use PLEs (Venkatesh et al., 2016).

Specifically, explaining teachers' intention to use PLEs, Expected Performance, Habit, and Hedonic Motivation play a dominant role (Papadakis & Kalogiannakis, 2019). These positive effects show that when teachers perceive a high Expected Performance of PLEs in the educational process, all other factors being equal, they are more likely to use them in the future. Similarly, teachers who view the platform as a habit and derive pleasure from it are more likely to use it in the future. The role of Expected Performance has also been reported in earlier studies on PLEs (Pynoo et al., 2011) and similar e-learning environments (Gunasinghe et al., 2020; Nikolopoulou et al., 2021; Raman & Rathakrishnan, 2018).

To explain teachers' actual use of PLEs, intention to use, habits, and easing conditions play a dominant role. These positive effects show that teachers who believe they will use PLEs in the educational process when other factors are equal are more likely to use them. Similarly, teachers who perceive the platform as a matter of habit and feel that sufficient organizational and technical infrastructure support PLE use is likelier to adopt it in the educational process. These effects are consistent with earlier studies on ICT use in education (Kim & Lee, 2020; Nikolopoulou et al., 2021).

The mediation analysis further clarifies the mechanisms underlying teachers' use of PLEs. Performance Expectancy and Hedonic Motivation were indirectly associated with Use Behavior via Behavioral Intention, showing that these factors relate to PLE use through teachers' intentions to use the technology. Habit showed a particularly key role, as it was associated with Use Behavior both directly and indirectly through Behavioral Intention. Specifically, the significant direct and indirect effects indicate complementary partial mediation. This finding suggests that Habit is associated with teachers' use of PLEs through two pathways: indirectly, through stronger Behavioral Intention, and directly, through habitual patterns of technology use. Thus, Behavioral Intention explains part, but not all, of the relationship between Habit and Use Behavior.

As supported by the findings, the absence of moderating effects in the UTAUT 2 model

could be attributed to the diverse cultural contexts of Greek teachers. This observation is also supported by research conducted by [Nikolopoulou et al. \(2021\)](#), which investigated Greek teachers' educational use of the mobile internet. Furthermore, it is worth noting that the model's interpretive power, with a percentage of explained variation close to 80%, of teachers' intention and actual use of the platform in the future is in line with previous research on technology use in education ([Kim & Lee, 2020](#); [Nikolopoulou et al., 2021](#)).

5 Implications and limitations

Given the findings, several practical recommendations can be formulated. With focus on expected performance of PLEs, education teacher consultants could emphasize the utility of PLEs in the educational process. This can be achieved by including these platforms in teacher training programs, emphasizing the benefits of PLEs in improving the educational process ([Nan Cenk et al., 2022](#)). Additionally, strategies for designing and implementing student-centered approaches and highlighting the general functions and features of PLEs that can enhance teaching efficiency and student engagement should be presented ([Tzavara et al., 2023](#)). With focus on the habits, the integration of PLEs into daily teaching routine could make it a habit. Teachers should start with small uses of the platform and gradually expand its application. Moreover, teachers could use PLEs regularly for lesson planning, assignments, and communication with students so to become more comfortable with the technology. With focus to enhance the hedonic motivation about the usage of PLEs, teachers could explore the enjoyable and engaging aspects of PLEs. They could find ways to make using these platforms fun and rewarding for both them and their students. They could share positive experiences and tips with colleagues to build a supportive community that appreciates the pleasure of using PLEs. Finally, PLEs could be incorporated into curriculum by aligning them with teaching objectives and learning outcomes. In this framework must be provided clear guidelines for students on how to use PLEs for their coursework and assignments.

It is important to note that this research is cross-sectional; therefore, caution should be exercised in inferring causation ([Creswell, 2012](#)). Additionally, the use of a single self-report questionnaire may have introduced common method variance ([Lavidas et al., 2022a](#)). As some full-collinearity VIF values exceeded the conservative threshold of 3.3, common method bias cannot be completely ruled out and should be considered when interpreting the findings. Future studies should consider longitudinal research with a representative sample, employing a cluster sample that includes teachers from various geographical regions of Greece. Furthermore, given that Perceived Value does not appear to explain teachers' intention to use or actual use of these environments for educational purposes, as previous research has indicated ([Nikolopoulou et al., 2021](#)), future studies might explore the removal of this construct from the research design to investigate technology intention for educational use ([Karakose et al., 2023](#)). Lastly, considering that the e-me platform is also used by other European countries ([Tzavara et al., 2023](#)), comparative studies on teachers' intention to use the platform could yield valuable insights.

Data availability statement

The datasets generated and/or analyzed during the current study are available upon request.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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