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Teaching digital competence in the use of YouTube and its incidental factors: Development of an instrument based on the UTAUT model from a higher order PLS-SEM approach

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Abstract: The increasing use of digital resources has changed the way of teaching, where platforms such as YouTube offer large repositories of educational videos. There are many theoretical studies that analyse the digital competences of teachers, but to a lesser extent on the behaviours and use that the teacher makes of this multimedia platform. Thus, the purpose of this study is the development of an instrument in which it is analysed how the behavioural intention of teachers on YouTube impacts their digital competence to search and select information, share information, and interact with other users of the platform, and create educational material. To achieve this, following the partial least squares (PLS) method of structural equation models, a higher-order causal model was proposed based on an adaptation and extension of the Unified Theory of Acceptance and Use of Technology (UTAUT). The study was carried out with a sample of 2157 teachers from all over Spain. The main result was that *behavioural* intention explained 22.70% of the true variance of teachers' digital competence. In addition, it has been possible to verify the reliability, convergent and discriminant validity of the established causal relationships, determining a model with acceptable goodness-of-fit. These findings show that it is a valid and reliable instrument to measure teachers'

digital competences on YouTube, behavioural intention, and the system of relationships between factors.

KEYWORDS
digital competence, ICT, PLS-SEM, teachers, UTAUT model, YouTube

Practitioner notes

What is already known about this topic

- Teachers can use YouTube to search and create creative and innovative educational lessons.
- The teacher must have adequate digital competence to search, select, evaluate, and effectively use the content of this platform in the classroom.
- The four central predictors of the UTAUT model (Unified Theory of Acceptance and Use of Technology) allow to explain and predict the adoption and use of ICT in different contexts.

What this paper adds

- The elaboration of an instrument on the digital competences of the teacher on the use of YouTube as a didactic resource, based on an extended model of UTAUT.
- Identification of the factors with the greatest incidence on the behavioral intention of the teacher to use YouTube as an educational resource.
- Identification of how the behavioral intention and the ease of the conditions determine the use of YouTube by teachers to search for educational content, share it or create it by themselves.

Implications for practice and/or policy

- Extensive information on the factors that teachers should pay attention to improve their behavioral intention to use YouTube as a teaching resource.
- The need to promote improvement policies on technological and digital conditions which will affect the digital competence of the teacher for the usability of YouTube as a more visual, verbal, and interactive educational process.
- Educational institutions should better prepare teachers for their role as innovative teachers, providing them with adequate digital skills in relation to the use of YouTube as a teaching resource.

INTRODUCTION

Thanks to technological advances in recent years, technology and Internet access have modified the teaching and learning methods between student-teacher (Şimşek & Ateş, 2022). This digital transformation is carried out through different digital media such as electronic books, exercise software, podcasts, or video platforms such as YouTube (Simelane & Govender, 2022).

From an educational and sustainable point of view, Tahat et al. (2021) highlight that YouTube can favour the teaching of students with educational needs, thereby achieving a greater inclusion in the educational process, as well as the reuse of available digital

videos (Chooprayoon & Sa-Ngiamwibool, 2020). In this sense, Colás-Bravo & Quintero-Rodríguez (2023, p. 1) underline that "its potential is based on its broad and rich content that can embrace very diverse educational needs, as was the fact that it provides open access to information for populations with a lack of resources or access to educational institutions". In addition, Zhou et al. (2020) assert that YouTube can be a key element in the teaching system as a social network due to its social features (subscribe, comment, and like). It can enable students to connect and communicate with other YouTuber-students in an open, creative, and collaborative online environment (Jung & Lee, 2015; Lee et al., 2017), thereby enhancing the interactive and social learning experience (Lee et al., 2017).

Multimedia learning is the key element of this social network in educational aspects, with a more visual and verbal type of teaching (Pratama et al., 2020). Moreover, Shoufan and Mohamed (2022) state that smartphones and their modern operating systems increasingly provide the user with a user-friendly interface to upload recorded videos effortlessly. These achievements have encouraged teachers and instructors to enter the world of YouTube with audio-visual content, so they had to improve their teaching and the instructional design of their subjects (Shoufan, 2021). Thus, these audio-visual resources and contents that will shape the teaching process should be reviewed from a pedagogical perspective. Instructional design attempts to reflect on how to teach, hence transforming educational materials and the methodological process itself in order to make learning more effective. In this sense, Doherty (2022) shows that the application of instructional design in training processes using YouTube increases the students' participation (affective, behavioural, and cognitive engagement), while the work of Muthmainnah (2022) found an improvement in academic performance in the subject of English language after an instructional design with content created and spread through this web platform. Therefore, it is essential that teachers think about how to use YouTube didactically and have the necessary digital skills (Guillén-Gámez & Ramos, 2021) to make the most of the opportunities on offer (Basilotta-Gómez-Pablos et al., 2022). Definitely, an in-depth study of these digital competences in teachers (Ray et al., 2021) and their application in the place of work-school is necessary (Oberländer et al., 2020) in what concerns the use of YouTube as an educational resource, and also taking into consideration theories that explain the effects of possible incident factors (Dyosi & Hattingh, 2018).

Incorporating academic knowledge through educational videos on YouTube is an innovative methodological alternative to more traditional learning processes (Ríos Vázquez & Romero Tena, 2022), since "the incorporation of technology helps motivate students to learn" (Carstens et al., 2021, p. 106). The implementation of YouTube in the classroom requires moderate digital skills and competence on the part of teachers (Fernández del Río & Barreira Arias, 2017), with the teacher's level of digital competence influencing both the improvement of their students' digital skills and their academic performance (Cabero-Almenara et al., 2023). However, the literature on digital learning has mainly focused on the content and format of learning, giving less relevance to learner behaviour (Noskova et al., 2021).

As technologies are increasingly integrated into educational processes, there has been an interest in building models of acceptance regarding the use of technologies by teachers (Granić & Marangunić, 2019), because the motivations for their use are more related to the attitudes and behaviour of the teacher than to the characteristics of the technology (Venkatesh & Davis, 1996). We highlight the TAM (Technology Acceptance Model), which explains the external factors that influence a person's beliefs, attitudes, behavioural intention and actual behaviour about a specific technology (Davis et al., 1989); the TPB (Theory of Planned Behaviour), which focuses on understanding the significant factors of intention with respect to technology acceptance (Ajzen, 1991); or the DTPB (Decomposed Theory of Planned Behaviour), which identifies the beliefs that influence the determinants of technology usage, providing a more complete understanding than the previous models

(Taylor & Todd, 1995). This project takes all these models into consideration and especially the UTAUT (Unified Theory of Acceptance and Use of Technology) developed by Venkatesh et al. (2003), which is based on both the TAM and other theoretical frameworks (Shachak et al., 2019), and is explained below.

UTAUT model

This model contributes to the investigation of the acceptance and use of technology (Venkatesh et al., 2003). According to UTAUT, "performance expectancy, effort expectancy, and social influence are theorized to influence behavioral intention to use a technology, while behavioral intention and facilitating conditions determine technology" (Venkatesh et al., 2012, p. 159).

This model is constantly evolving due to the addition of new factors or new interrelationships (Kundu et al., 2021). This was the case with the addition of the "IT Capability" factor (Shah et al., 2021) or the "Perceived self-efficacy" factors (Agyei & Razi, 2022), giving a better explanation of the acceptance and use of innovative technologies and methodologies. Regardless of the extent of the UTAUT model, studies have confirmed that the UTAUT model has been used to successfully evaluate the acceptance of technology in educational contexts in different settings, such as in the use of interactive whiteboards (Šumak et al., 2017), virtual classrooms (Alshammari, 2021), MOOCs (Altalhi, 2021), or learning platforms (Khechine & Augier, 2019).

Conceptual framework between the UTAUT and YouTube

Not many studies analyse the extension and conceptualization of the UTAUT model in teachers' behavioural intention to use YouTube as a learning resource, and how the relationship of these antecedent factors predicts the digital competences of teachers to integrate this educational resource in the classroom. Therefore, we implement the UTAUT model in the use of YouTube as an educational resource and investigate its effects on the role of teachers' digital competence, understood as "a set of basic knowledge, skills, abilities, and other characteristics that enable people at work to efficiently and successfully accomplish their job tasks regarding digital media at work" (Oberländer et al., 2020, p. 11).

We will investigate, on the one hand, the knowledge and skills regarding searching and filtering academic content on YouTube according to its quality (Tadbier & Shoufan, 2021), allowing us to select those videos that best meet the students' interests (Klobas et al., 2018). On the other hand, we will analyse the technical knowledge required to design, create and produce audio-visual material with the teachers' own content (Ortega-Rodríguez et al., 2022). We will focus our attention on the technical and formal aspects regarding production (Lijo et al., 2022), the appropriate length of the videos (Gerhart & Anderton, 2021), and how to design interesting and motivating content for students (Dascalu et al., 2021), to make a change from the typical lectures (Scagnoli et al., 2019).

The original model focuses on how several factors explain behaviour as to the use of technology, adapted to the educational scenario of YouTube is explained below:

- The *Effort Expectation (EE)* factor is defined as "the degree of ease associated with using the system" (Venkatesh et al., 2003, p. 450). In the study, it is associated with the degree of ease of using YouTube for educational purposes. Different authors (Elareshi et al., 2022; Habes et al., 2021) pointed to this factor as a significant determinant of the BI factor on the benefits of YouTube for educational learning.

- The *Performance Expectation (PE)* factor is understood as "the degree to which an individual believes that using the system will help him or her to achieve gains in job performance" (Venkatesh et al., 2003, p. 447). Several research studies (Bardakci, 2019; Habes et al., 2020; Jung & Lee, 2015) have validated this factor as a significant determinant of the BI factor on YouTube usage.
- The *Social Influence (SI)* factor is conceived as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). The predictive relationship of the SI factor with BI has also been evidenced, as students may be influenced by the ideas of their peers about the usefulness of YouTube and may take certain actions (El-Masri & Tarhini, 2017) that make them very likely to incorporate YouTube into their learning (Ramírez-Correa et al., 2019).
- *Behavioural Intention (BI)* is defined as "an individual's positive or negative feeling about performing the target behaviour" (Fishbein & Ajzen, 1975, p. 216). We refer to the feelings that influence a person to perform a behaviour (Elareshi et al., 2022), linked in this study to teachers' intention to use YouTube as an educational resource. The UTAUT model postulates that the BI factor is an important predictor of how technology is actually used, as evidenced by different studies on YouTube or Stream Yard (Nandika et al., 2019; Retnowardhani & Setyawan, 2022). In our research, we understand the usage factor as the digital competencies (DC), in which the teacher needs to use a specific technology such as YouTube, influenced by three inter factors. These are focused on digital skills that allow: (1) searching and selecting information through YouTube videos (DC-I); (2) communicating information and interacting with other users of the web platform (DC-C); (3) creating audio-visual teaching material, geared towards the transfer of academic knowledge of the curriculum (DC-CC).
- The *Enabling Conditions (EC)* factor is described as "as degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003, p. 453). This CE factor is not seen as a direct determinant of the BI factor, but of the digital skills to use YouTube itself (Jung & Lee, 2015). Some studies have shown how students' or teachers' perceptions of Internet access and the quality of technological resources can influence its own use (Yus & Jayadi, 2022). However, this variable has been categorized from different points of view in relation to the researcher's understanding of enabling conditions (Lin et al., 2013). This study interpreted this factor as the skills needed by teachers to position YouTube as a helpful resource for the students' teaching-learning process.

Considering this conceptual framework, this study aims to develop an instrument to analyse how teachers' behavioural intentions regarding the use of YouTube as a learning resource, together with other factors of the extended UTAUT model, impact their digital competences required to: (1) search and select information through YouTube videos; (2) share information and interact with other users of the web platform; and (3) create educational material, in audio-visual format, aimed at the transfer of specific academic knowledge. This project has an impact at the practical and empirical levels due to the conceptual-methodological development through the application of variance-based structural equations (PLS-SEM). It represents a significant advance not only in causal methodology, applied to the analysis of YouTube as a didactic resource, but also at a training level. It will assist teacher training centres in formulating policies that effectively help the training, intention, and integration of this learning resource by students.

Figure 1 illustrates the original model proposed by Venkatesh et al. (2003), as well as the extension to the proposed model for this study. Each factor is configured as an endogenous or exogenous variable depending on the hypothesised relationships in the model. As exogenous factors: PE, EE, SI, and EC. As endogenous factors: BI, DC, DC-I, DC-C, and DC-CC.

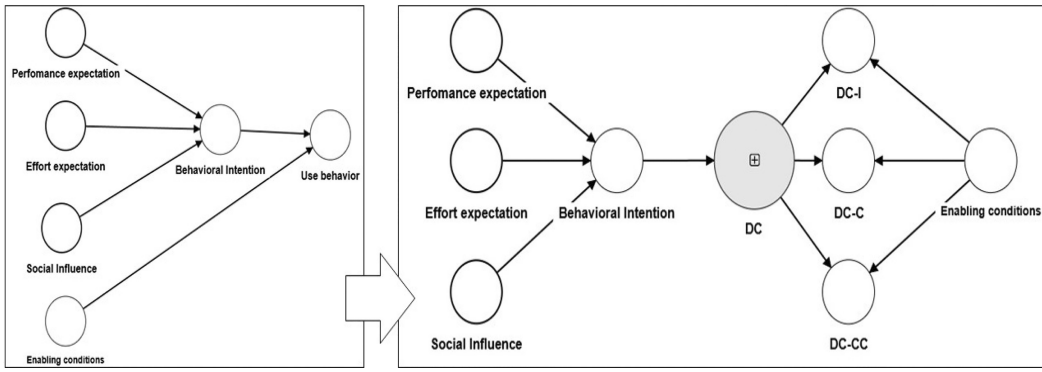

FIGURE 1 Design from the initial theoretical model to the proposed model. *Source*: Own elaboration.

The factors DC-I, DC-C, and DC-CC represent the LOC factors of the DC factor, which is HCO, explaining these nomenclatures in the following section.

Therefore, this study postulated the following hypothesis:

H1. The EE factor is a significant predictor of the BI factor.

H2. The PE factor is a significant predictor of the BI factor.

H3. The SI factor is a significant predictor of the BI factor.

H4. The BI factor is a significant predictor of the CD factor.

H5. The DC factor is a significant predictor of the DC-C factor.

H6. The DC factor is a significant predictor of the DC-CC factor.

H7. The DC factor is a significant predictor of the DC-I factor.

H8. The EC factor is a significant predictor of the DC-C factor.

H9. The EC factor is a significant predictor of the DC-CC factor.

H10. The EC factor is a significant predictor of the DC-I factor.

METHODOLOGY

Design and sample

A quantitative, non-experimental, cross-sectional approach was used. As the instrument is a causal model, its nature is descriptive-explanatory, allowing us to explain the relationship between the factors based on theoretical models (Cepeda-Carrion et al., 2018). The type of sampling was non-probabilistic and purposive. The participants were teachers from all over Spain currently active at different educational stages: Early Childhood Education, Primary Education, Secondary Education, Adult Education, and Vocational Training. To collect the data, the authors contacted the teachers by email, providing them with a link to carry out a

survey, guaranteeing the confidentiality and privacy of the data. This process was carried out in September 2022. Once the data were collected, they were cleaned by eliminating missing or incomplete data from the teachers (Table 1). Furthermore, participants who had no previous experience with YouTube were eliminated, as the items in the instrument are designed to be answered by teachers who have used YouTube as a teaching resource in the classroom. For this purpose, a question was created at the beginning of the questionnaire: "Have you used or are you currently using YouTube as a teaching resource in your subjects?" Yes/no. As a result, the sample consisted of a total of 2157 teachers. In addition, a demographic question was asked about the educational purpose of using YouTube, in order to gain a deeper understanding of the use that teachers make of this platform. The question was: "For what educational purpose do you use YouTube in your classes?"

Estimation techniques and software

To examine the data, a causal model through partial least squares structural equations (PLS-SEM) was used with Smart-PLS 4 software (Sarstedt & Cheah, 2019). PLS-SEM is a non-parametric method where the recommended scale of measurement is ordinal, and the Likert scale is positioned as one of the most suitable (Hair, Matthews, et al., 2017). For the creation of the responses, a 7-point Likert scale was used, where each value on the scale was associated with a specific digital skill: (1) I am unable to do it; (2) I am able to do it but I need help; (3) I can do it on my own with great difficulty; (4) I can do it on my own with difficulty; (5) I can easily do it on my own; (6) I can very easily do it on my own; (7) I can show other teachers how to do it.

The A-mode algorithm was used to estimate the reflexive-reflexive measurement model (Becker et al., 2012), through the hierarchical component technique (repeated indicators approach). In this type of approach, the lower-order component-factors (LOC) are assigned to a higher-order component-factor (HCO) (Lohmöller, 2013).

The first step was to carry out the evaluation of the measurement model by checking the reliability of the instrument and how well it was understood. Subsequently, the hypothetical measurement model (direct impact between exogenous and endogenous variables) was evaluated through the path coefficients. To do so, the measurement criteria were varied according to the path relationships established between the LOC and HCO factors. First, the HOC factor must show discriminant validity considering all its LOC factors. Second, Sarstedt et al. (2019, p. 4) state that "the lower-order components must exhibit discriminant validity

TABLE 1 Sample distribution.

Demographics			
Genre	Female (70.80%, $n=1527$)	Educational stage	Early childhood (10.50%, $n=226$)
	Male (29.20%, $n=630$)		Primary education (41.10%, $n=887$)
Age	Female (42.69 ± 10.26)		Secondary education (30.50%, $n=657$)
	Male (44.94 ± 10.64)		Adult education (9.30%, $n=201$)
			Vocational training (8.60%, $n=186$)
Purpose to use YouTube	Educational tutorials (21,90%, $n=473$)		
	Knowledge research (11%, $n=238$)		
	Explanation of contents (25.50%, $n=550$)		
	Reinforce knowledge (33.90%, $n=731$)		
	As evaluative resource (7.60%, $n=165$)		

among each other and to all other constructs in the model-except for their own higher-order component of which they are a part of." The assessment of LOC factors must therefore be based on the standard reliability and validity criteria for reflective measurement models (Latan & Noonan, 2017). And third, for the relationships of the HOC factor with the rest of the factors that do not belong to the LOC factor, the standard structural model assessment criteria are applied. Inspired by Ramírez-Orellana et al. (2021), Figure 2 shows the general flowchart of the research methodology used.

RESULTS

Assessment of the lower-order model

The first step is the evaluation of the reflective model through the reliability and convergent validity of the items of each latent factor (Sarstedt et al., 2014). Regarding the internal consistency of the model, the factor loadings of each item, Cronbach's alpha of each factor, composite reliability (CR) and average variance extracted (AVE) have been analysed (Chin et al., 2010). Regarding the factor loading of each item, it is recommended to eliminate those with values lower than 0.71. Table 2 shows all the items that meet the recommended criteria, with a range from 0.71 to 0.95, eliminating those that did not exceed the threshold (PE2, PE5, SI2, SI4, EC1, EC2, DC-I1, DC-C1, DC-C1, DC-CC1, DC-CC2, DC-CC3). Regarding Cronbach's alpha index, Hair et al. (2019) recommend that the coefficient of each factor should be above 0.70. It is observed that all latent factors have values above the recommended value. Although Cronbach's alpha index has traditionally been used as an internal measure of reliability, it tends to show very conservative values in PLS-SEM, so the literature has shown that there are other indices (Composite Reliability, CR) that can provide a better fit in causal models (Bagozzi & Yi, 1988). CR is typically examined using Jöreskog's (Jöreskog, 1971) measure, where recommended values are to be above 0.70 (Hair et al., 2019). It is observed that CR index values range from 0.74 to 0.95. The next step was to test for convergent validity, which measures the degree to which an item correlates positively with the other items of the same factor (Sarstedt et al., 2014). To check this, the average variance extracted (AVE) of each latent factor must be above 0.50 to corroborate this type of validity (Ab Hamid et al., 2017). It is observed that all AVE values are above the recommended threshold.

Therefore, with the values found for each index, an adequate internal consistency and convergent validity of the lower-order factors of the model are corroborated. Finally, the higher-order factor DC obtained a reliability of 0.93, a composite reliability of 0.93, and an AVE of 0.56, indicating convergent validity for DC (Sarstedt et al., 2021).

The next step is to look into discriminant validity. As Riady et al. (2022, p. 17) state, "discriminant validity assesses the extent to which a construct is different from other constructs". This will be examined through two types of analysis and criteria: Forner-Lacker and HTMT (the heterotrait-monotrait). It should be taken into consideration, as stated by Sarstedt et al. (2019) and Hair, Sarstedt, et al. (2017), that discriminant validity should not be tested for a higher-order model (HOC) with respect to its lower-order factors (LOC). In our case, the DC factor repeats the items of the lower-order factors (DC-I, DCC, and DC-CC). That is, the discriminant validity between DC-I, DC-C, and DC-CC and their higher-order factor DC will not be subject to analysis, so they will appear blank (–).

The Fornell-Larcker criterion is used to analyse the AVE coefficient. To meet this criterion, Riady et al. (2022) state that a latent factor must not exhibit a variance shared with another latent factor greater than its AVE value. In other words, it is tested whether the square root value of each AVE (there is one for each latent factor) is greater than any correlation

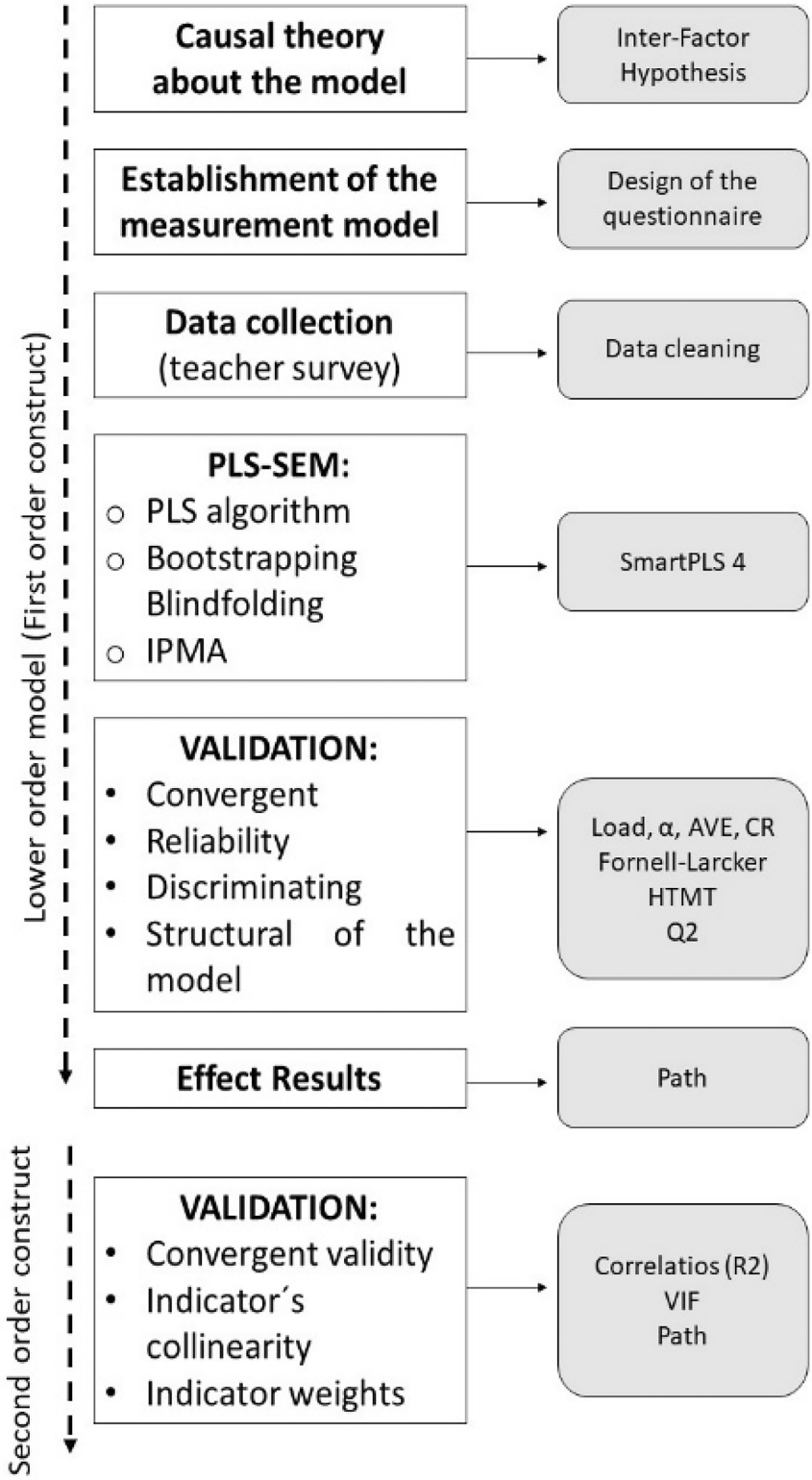

FIGURE 2 Overall research methodology flowchart. *Source*: Own elaboration.

TABLE 2 Loading, α, CR, AVE.

Factor-item	Load	α	CR	AVE
Performance expectation (PE)		0.94	0.94	0.77
PE1 (Using videos to explain theoretical content helps students understand)	0.87			
PE3 (Using videos allows me to strengthen the contents of my subject)	0.89			
PE4 (Using videos to improve my teaching makes students more focused)	0.90			
PE6 (Using videos makes my students learn faster)	0.88			
PE7 (Using videos improves my educational innovation as a teacher)	0.85			
PE8 (Using videos makes my teachings more dynamic and interactive)	0.88			
Effort expectation (EE)		0.82	0.85	0.64
EE1 (Using educational videos for my teaching is easy)	0.84			
EE2 (Selecting educational videos for my teachings takes little time)	0.76			
EE3 (Using videos in my teaching reduces the workload, in and out of school)	0.74			
EE4 (The digital skills needed to use videos in my teaching are easy to develop)	0.85			
Social influence (SI)		0.73	0.74	0.55
SI1 (My fellow teachers think that I should use YouTube in my classes as an educational resource)	0.71			
SI3 (The teachers at my centre who use ICT (for example, YouTube) are more recognized by the educational community than those who do not use it)	0.72			
SI5 (I consider that ICT training could influence my decision to use this educational resource in my teachings)	0.81			
SI6 (I consider using YouTube as an educational resource if my fellow teachers get good results with their students)	0.82			
Behavioural intention (BI)		0.93	0.94	0.83
BI1 (I intend to use YouTube as an educational resource for my teachings)	0.90			
BI2 (I am willing to train in digital resources such as YouTube to use them in my teachings)	0.91			
BI3 (I plan in the near future to continue learning how to use YouTube to improve the teaching process)	0.91			
BI4 (I would consider using YouTube to carry out reinforcement and extension learning)	0.93			
Enabling conditions (EC)		0.82	0.94	0.72
EC3 (I believe that it is beneficial for my students to take advantage of the technological resources that the school offers)	0.82			
EC4 (In the subjects I teach it is very easy to use YouTube as a complementary resource)	0.83			
EC5 (I think I have enough digital skills as a teacher to use YouTube in the teaching-learning process)	0.91			

TABLE 2 (Continued)

Factor-item	Load	α	CR	AVE
Digital Competence—Information (DC-I)		0.85	0.85	0.77
DC-I2 (I know how to use search filters to find more precise information)	0.91			
DC-I3 (I know how to use the "explore" function to find featured videos within the categories proposed on YouTube"	0.88			
DC-I4 (I know how to assess whether the content of the videos is appropriate based on the educational activity)	0.86			
Digital Competence—Communicate (DC-C)		0.90	0.90	0.71
DC-C2 (I know how to subscribe to a YouTube channel to get alerts when the channel creator uploads a new video)	0.87			
DC-C3 (I know how to comment on YouTube videos)	0.90			
DC-C4 (I know how to show my reaction to a YouTube video (like/dislike))	0.86			
DC-C5 (I know how to participate in a YouTube live chat)	0.80			
DC-C6 (I know how to share a video on YouTube)	0.80			
Digital Competence—Content Creation (DC-CC)		0.95	0.95	0.82
DC-CC4 (I know how to upload several videos and combine them to create a more complete video)	0.91			
DC-CC5 (I know how to cut fragments of the video and add transitions and text)	0.92			
DC-CC6 (I know how to insert annotations and web links inside my videos to make them more interactive)	0.95			
DC-CC7 (I know how to add subtitles to my videos)	0.92			
DC-CC8 (I know how to mark my videos with a Creative Commons CC BY licence)	0.83			
Orden Superior (HOC-DC)		0.93	0.93	0.56

Source: Authors' calculations.

between any pair of latent factors (Gefen & Straub, 2005). Table 3 shows the values found when applying this criterion, where the coefficients with a grey background (square root AVE) are greater than the values below the diagonal (correlations between factors), thus fulfilling the Fornell-Larcker criterion (Fornell & Larcker, 1981).

As a final criterion to assess the discriminant validity of the lower-order model, Henseler et al. (2015) suggested analysing the heterotrait-monotrait ratio (HTMT) as a method that can achieve better specificity and sensitivity rates than the other criteria that make up discriminant validity. Ab Hamid et al. (2017) determine that values close to 1 would indicate a lack of discriminant validity. Other authors suggest a threshold of 0.85 (Kline, 2015), while others focus on 0.90 (Franke & Sarstedt, 2019; Henseler et al., 2015). Table 4 shows that the HTMT criterion was met for our PLS model. We find support for this type of lower-order factor validity, as all HTMT values are below the conservative threshold of 0.85.

Assessment of the structural model

To carry out the model evaluation, Henseler et al. (2009) recommended five consecutive steps: (1) multicollinearity analysis; (2) path analysis; (3) finding out the coefficient of

TABLE 3 Fornell-Larcke criterion.

	BI	DC	DC-C	DC-CC	DC-I	EC	EE	PE	SI
BI	0.91								
DC	0.48	0.75							
DC-C	0.45	–	0.85						
DC-CC	0.27	–	0.55	0.91					
DC-I	0.55	–	0.68	0.52	0.88				
EC	0.67	0.50	0.50	0.31	0.48	0.85			
EE	0.57	0.37	0.34	0.26	0.38	0.68	0.80		
PE	0.60	0.26	0.26	0.13	0.30	0.64	0.68	0.88	
SI	0.50	0.17	0.15	0.11	0.18	0.41	0.51	0.52	0.74

Source: Authors' calculations.

TABLE 4 HTMT ratio.

	BI	DC	DC-C	DC-CC	DC-I	EC	EE	PE	SI
BI									
DC	0.50								
DC-C	0.49	–							
DC-CC	0.28	–	0.60						
DC-I	0.61	–	0.77	0.58					
EC	0.76	0.52	0.54	0.31	0.54				
EE	0.62	0.40	0.37	0.28	0.42	0.79			
PE	0.64	0.27	0.28	0.13	0.33	0.76	0.75		
SI	0.59	0.23	0.19	0.19	0.23	0.55	0.67	0.62	

Source: Authors' calculations.

determination (R^2); (4) finding out the effect size coefficient (f^2); (5) predictive relevance of the model.

1. *Collinearity*. Collinearity was calculated for the variance inflation factor (VIF) (Kock, 2015), with collinearity problems existing with values above 3 (Hair et al., 2019). For the proposed model, Table 5 shows the VIF values calculated among the formative factors in the model, with values below 3.
2. *Path or standardized coefficient (β)*. The significance of the path (the directional relationships between the latent factors) was analysed. To test this, the bootstrapping procedure was used where "a large number of sub-samples (eg, 5000) are taken from the original sample with replacement to give bootstrap standard errors, which in turn gives approximate *t*-values for significance testing of the structural path" (Wong, 2019, p. 34). This procedure shows the path coefficient (*P*), standard deviation (*SD*), *t*-statistic (*t*-value), and significance value with 95% interval (*p*-value). Table 5 shows the values obtained through this procedure, for each hypothesis.

Hypothesis 1 determines whether effort expectancy plays a significant role in teacher behavioural intention. Results revealed a significant *path* between the two factors ($\beta = 0.23$, p-value $= 8.12$, $p < 0.001$), accepting H1. Hypothesis 2 tested whether performance expectancy significantly predicted behavioural intention. Results showed that

TABLE 5 Structural model.

Hypothesis	Relationship	VIF	β	*SD*	*p*-Value	*p*-Value	Supported	*f*
H1	EE → BI	1.98	0.23	0.03	8.12	<0.001	YES	0.05
H2	PE → BI	2.03	0.34	0.03	11.79	<0.001	YES	0.10
H3	SI → BI	1.46	0.20	0.02	9.77	<0.001	YES	0.05
H4	BI → DC	1.00	0.48	0.02	24.05	<0.001	YES	0.29
H5	DC → DC-C	1.33	0.84	0.01	103.05	<0.001	YES	2.45
H6	DC → DC-CC	1.33	0.91	0.01	99.01	<0.001	YES	2.27
H7	DC → DC-I	1.33	0.77	0.01	62.73	<0.001	YES	1.37
H8	EC → DC-C	1.33	0.08	0.01	6.99	<0.001	YES	0.02
H9	EC → DC-CC	1.33	0.14	0.01	9.92	<0.001	YES	0.05
H10	EC → DC-I	1.33	0.09	0.02	5.81	<0.001	YES	0.02

Source: Authors' calculations.

performance expectancy significantly affected teacher behavioural intention ($\beta = 0.34$, p-value = 11.79, $p < 0.001$), H2 is supported. H3 hypothesised that social influence has a significant effect on behavioural intention to use YouTube as a teaching resource. PLS-SEM findings revealed that social influence had significant predictive power on teachers' behavioural intention ($\beta = 0.20$, p-value = 9.77, $p < 0.001$) which argues for H3. H4 focuses on whether behavioural intention has a significant relationship with behavioural intentions; results confirm the hypothesis ($\beta = 0.48$, p-value = 24.05, $p < 0.001$). Hypotheses 5–7 focus on whether digital competence significantly affects their internal factors. As this is a higher-order factor together with its three lower-order factors, the hypotheses were significant in all cases. H8 tests the relationship between the facilitating conditions and DC-C. The link between the two factors is significant, reporting a t-value of 6.99 ($\beta = 0.08$, p-value < 0.05). Therefore, H8 is accepted. The significant relationships between the facilitating conditions and the factor DC-CC ($\beta = 0.14$, p-value = 9.92, $p < 0.001$) and DC-I ($\beta = 0.09$, p-value = 5.81, $p < 0.001$) are also accepted.

3. *Coefficient of determination (R^2)*. This coefficient can be understood as the variance of an endogenous factor which can be explained by its predictor variables in the model (exogenous factor). According to Hair et al. (2011, 2021), R^2 values at the threshold of 0.25, 0.50 and 0.75 represent weak, moderate, and substantial levels. Figure 3 shows that the model has good explanatory power: 0.43 for BI, 0.23 for DC, 0.673 for DCI, 0.783 for DC-C, and 0.72 for DC-CC.
4. *Effect size coefficient (f^2)*. To assess the strength of the relationship between the factors, the effect size is used. This was calculated using the f^2 procedure proposed by Cohen (1988), where a value equal to or less than 0.02 is interpreted as a small effect, a value of 0.15 as a medium effect, and a value of 0.35 as a large effect. Through the PLS-SEM calculation, the values of f^2 ranged from 0.020 to 2.45. Detailed information on the effect sizes for each pathway is shown in Table 5.

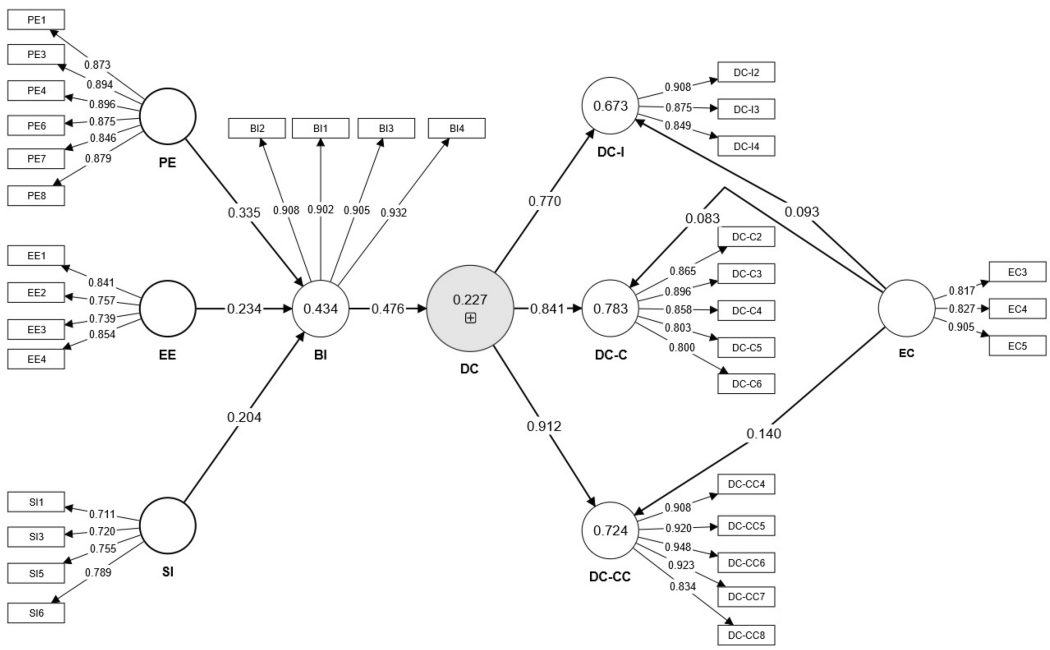

FIGURE 3 Smart-PLS—path analyses with *R*-square values. *Source*: Authors' calculations

5. *Predictive power*. Stone (1976) states that the predictive power of the model has also been analysed through the predictive sample reuse technique, with the Stone-Geisser criterion (Q^2) (Geisser, 1975). According to Hair et al. (2021), the model has predictive relevance when Q^2 is greater than 0. According to Riady et al. (2022), the effect sizes of the Q index^2 could be interpreted as follows: values of 0.02, 0.15, and 0.35 would indicate that an exogenous factor has small, medium, and large predictive power for an endogenous factor, respectively. The blindfolding data report the following prediction sizes: BI, $Q^2 = 0.43$, large; DC, $Q^2 = 0.10$; small; DC-C, $Q^2 = 0.13$, medium; DC-I, $Q^2 = 0.15$, medium; DC-CC, $Q^2 = 0.03$, small. Therefore, predictive ability is established.

Importance-performance map analysis

Importance-performance map analysis (IPMA) extends the results of path coefficients by understanding the performance of exogenous factors in explaining a specific endogenous factor (Ringle & Sarstedt, 2016). This technique compares the total effects (defined as the effects of predecessor factors) in predicting a given target factor. In our case, the aim is to identify the antecedent factors (PE, EE, SI, and BI) that have a relatively high effect in predicting the target factor (higher-order factor, CD). The scatter plot (Figure 4) shows how the BI factor represents the highest chance of achieving an improvement in the three factors analysed (DC-C, DC-I, and DC-CC), followed in both cases by the PE factor. It should be noted that the EC factor has a low effect on the performance of the DC-CC factor. To increase the performance of the DC-CC factor, the first priority should be to improve the performance of EC, as this factor is of great importance, despite having a low effect.

DISCUSSIONS

The analysis of the YouTube phenomenon in educational contexts is conducted both from perspectives relating to the differentiated content of education, as well as the individual and environmental conditions that allow for the effective use of this type of OER (Open Educational Resources) (Duffy, 2008; Jones & Cuthrell, 2011; Kabooha & Elyas, 2018; Kruse & Veblen, 2012). Crucial to the implementation of YouTube is discovering the determinants that relate not only to learners' 'consumption' of educational content, but also those determinants residing on the side of teachers (Pattier, 2021). The modern teacher is not only a recipient of ready-made content prepared by other educators, hobbyists, and online learning enthusiasts, but is also an expert who should create and share via this type of e-service

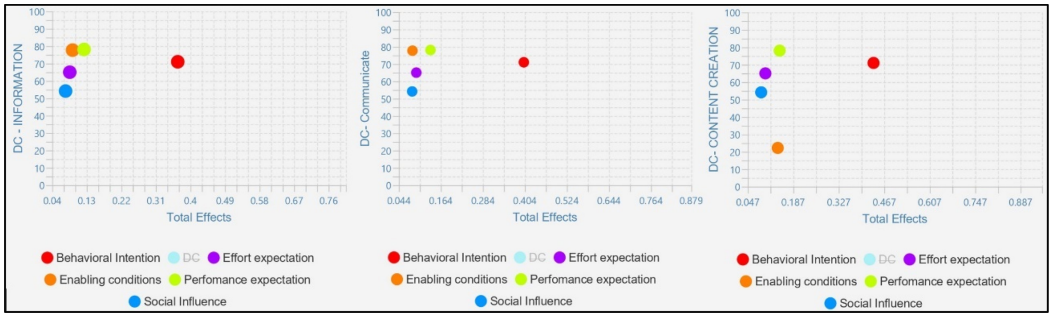

FIGURE 4 Importance-performance map graph. *Source*: Authors' calculations.

their own content tailored to the learning objectives and specific characteristics of learners (Ali et al., 2022; Portugal et al., 2018).

This article seeks to provide an in-depth exploration of the extent to which the critical factors related to the assessment of the didactic effectiveness of YouTube, the ease of use of this type of solution from a methodological perspective, the social (school) impact on the use of YouTube, attitudes towards the analysed service, and ease of implementation and digital competence each relate to the use of the platform. On the one hand, this study is part of a series of reports on the determinants of YouTube implementation, while on the other hand, it allows the capture of the intersecting determinants residing in the environment of the teacher and the school. Another key area, which relates to the practical considerations of the platform, emerged in this paper. The research was intended not only to diagnose the set of determinants of the style of YouTube use in the teaching and learning process from the teachers' perspective, but to contribute to the discussion on the elaboration of indicators and variables to measure the use of selected educational technology in the context of receiving, editing, and sharing information of importance from a teaching perspective. The research model presented can therefore be useful in the further assessment of changes in the pedagogical style of use of the YouTube platform by Spanish teachers, as well as to serve as a comparative study, and be transposed and implemented to assess the style of use of other platforms based on Video on demand.

Using the repeatedly confirmed UTAUT theory, it was concluded that behavioural intention (BI) is related to effort expectation (EE). Thus, increasing one's sense of the ease of use of YouTube stands in relation to an internal positive attitude towards the use of this type of e-solution. This relationship is known from other reports relating to the implementation of new technologies in education (Al Masarweh & Afandi, 2022; Scherer et al., 2019, 2020). The present hypothesis H1 is therefore not only confirmed (statistically significant) by the results of the present study, but also by the other cited studies. A sense of ease of use of any new ICT is therefore one of the first key elements to the success of experimenting with and implementing new solutions. This type of relationship is evident among novice teachers, or those experimenting with the implementation of software and websites in education (Tomczyk, Jáuregui, et al., 2020). It should be emphasized that BI is also conditioned by the specificity of the medium analysed, as by definition YouTube and similar sites are directed towards ludic purposes. The change in BI also proceeds with a reorientation of EE from the perspective of the user-consumer of entertainment content to the user-creator of educational content.

The relationship for H2, linking behavioural intention (BI) to performance expectation (PE), is worthy of interest and has been confirmed. H2 shows that as YouTube's performance rating increases, the internal sense of necessity to use the service also increases. This may be due to previous experiences of using relatively easy-to-use services that make use of the ability to share one's own files (eg, podcasts, presentations, online courses). A belief in the effectiveness of a given e-solution may therefore be derived from previous experience with educational software (edtech) or from an idea of the educational potential of a given solution (Potyrała, 2017). Therefore, it is worth emphasizing that the PE variable can also be developed through experimentation, discovery, intensive use of new media, or participation in awareness-raising activities about the potential of ICT use, most notably YouTube (Stosic et al., 2020).

The data collected also show that the hypothesis (H3) on the relationship between social influence (SI) and behavioural intention (BI) is statistically significant and therefore the hypothesis has been confirmed. Although the relationship does not exceed the medium β level, it shows that in the overall perception of the educational use of YouTube, SI is also significant. How other teachers use the aforementioned e-service, how patterns related to the delivery of educational material in the school environment are shaped, and how other teachers using YouTube are perceived, all influence internal decisions related to the implementation of the

software. With social learning being a general concept found primarily outside of media pedagogy, in this case it has become one component of SI (Huk, 2019; Jackson & Bruegmann, 2009; Vizcaíno-Verdú & Abidin, 2023). It is also important to be aware that SI does not affect all, but selected teachers (as evidenced, for example, by the R^2 coefficient). However, one issue that should be clarified in further research into this relationship is susceptibility to the influence of other teachers in the selection of digital teaching resources, as well as general attitudes towards new media, which can be linked directly to SI (Tomczyk, Potyrała, et al., 2020).

The factors responsible for the successful implementation of ICT in education are legion. One is the level of digital competence (DC). The data collected confirm the relationship between the previously discussed BI and DC. Therefore, due to the level of statistical significance that has been attained, H4 can be confirmed. An increase in one of the factors also results in an increased proficiency in the use of new media (in the case analysed, YouTube). The colloquial statement 'to want is to be able' takes on a new meaning in the context analysed. The intention to use the analysed e-service therefore has a significant impact on the level of self-assessment of digital competence. Strengthening awareness of the use of YouTube is therefore a factor linked to DC, which in turn enables the reorientation of the implementation of new media according to the principle from passive consumer to active creator of digital content such as multimedia OER (Iwanicka, 2018).

The model presented also demonstrates the importance of digital competences, which have moved beyond descriptions of how software and e-services are handled and now include a wide range of very specific teaching activities with practical reference to specific ICT-mediated activities (Knezek et al., 2023; Toto & Limone, 2021). The diversity and multidimensionality of DC is also evident for the operation of YouTube within which it is necessary to have knowledge and skills related to searching for educational material, creating alerts, sharing educational content, commenting, editing, uploading, adding textual information, or possessing knowledge of copyright issues. As the collected data confirm, the growth of one DC area (D-CI, D-C, D-CC) contributes very strongly to the overall growth of DC (H5–H7). Hypotheses H5–H7 were clearly confirmed. In other words, the growth of one area of DC is able to enhance another dimension of DC, a phenomenon that is extremely beneficial from the perspective of increasing the efficiency with which ICT is used. This observation is particularly important in the context of designing effective LLL programmes that enhance teacher DC (Garzón-Artacho et al., 2021; Uzunboylu & Selcuk, 2016). The three hypotheses (H5–H7) can thus be considered as a group of co-occurring elements within a broader conception of digital competence, which was clearly confirmed by the data collected among Spanish teachers. OER information retrieval, creation, and management of educational content are, as H5–H7 show, intersecting areas that, when linked, build a wide definition of teacher digital competence.

The model presented (H8–H10) also highlights the relationship between Enabling Conditions (EC) and the different dimensions of DC. Hypotheses H8–H10 were confirmed. This relationship is characterized by statistical significance; however, the level (β) is not highly significant for DC development. Enabling conditions relating to the ease of implementation of YouTube in subject teaching or, for example, school infrastructure is currently not very significant for the analysed dimension. In the case of YouTube, once formed, the aforementioned DC are usually stable or undergo minimal changes. The speed of the Internet connection, the use of a web browser, and the ability to edit simple videos, are activities that, once acquired, constitute a core that is not subject to change within the framework of the mentioned teacher-independent conditions (for example, in this research model exemplified by the variable EC). In summary, this means that the DC associated with creating, searching for, and editing OER on YouTube are not in a strong and simple linear relationship with EC (H8–H10), but their development is based more on factors categorized, for example BI (H2) (Vázquez & Tena, 2022).

CONCLUSIONS

Using the potential of new media to enhance the didactic process is not a simple task, though nor is the effective implementation of analogue solutions (Thorvaldsen & Madsen, 2021; Tveiterås & Madsen, 2022). Each didactic resource or learning environment is characterized by a few considerations related to effective implementation. In the case analysed, elements such as BI, DC, and PE are of particular importance, as it is their reinforcement that contributes to the intensive growth of the other elements identified in the model that translate into the realization of the potential inherent in YouTube. The study presented here is one more voice in the discussion, showing how complex the use and implementation of media in education is in the context of external conditions and teacher DC (Cabero-Almenara et al., 2022).

This research not only shows the range of conditions allowing the use of YouTube in education but is also an attempt to find answers as to which elements need to be strengthened so that easily accessible digital teaching resources are used much more frequently in different educational stages and contexts. This is a particularly important task in view of the overarching goal of achieving digital maturity, whereby societal expectations (linked to the modernization of schools) combine with the potential of new media, as well as the individual capacities of teachers and students.

The results of this research clearly indicate the necessity of multidimensional strengthening of digital competences, in which behavioural intentions become one of the most important determinants of teachers' style of using YouTube as a tool. The results confirm that teachers' digital competence is a complex system in which the technical operation of a given edtech is conditioned in a multifactorial way, thus not only through the provision of an adequate infrastructure, but the simultaneous strengthening of BI. Therefore, the planning of activities based on the LLL strand requires consideration of the model here presented, in which the layers of technical handling skills, intentions, or infrastructure intersect, thus conditioning the quality of the use of OER such as YouTube in education.

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