JOURNAL OF NEW APPROACHES IN EDUCATIONAL RESEARCH
2022, VOL. 11, NO. 2, 168-185, e-ISSN: 2254-7339
https://doi.org/10.7821/naer.2022.7.789

ORIGINAL

Mediation Models Predicting the Level of Digital Competence of 12-14 Year Old Schoolchildren in the Area of Digital Problem Solving

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ABSTRACT

Technology has become invaluable and digital competence has turned into a necessity for students. The research presented here aims to propose mediation models that explain the influence of attitudinal, technology use, and family factors on the level of digital problem-solving skills of compulsory education students (12-14 years old). A quantitative methodology with a cross-sectional design was used. We worked with a sample of 772 students from 18 Spanish educational centres according to a stratified random sampling method. For data collection, an objective assessment test was used for knowledge and skills, and a Likert scale for attitudes. Regression analyses were carried out by creating theoretical reference models based on the bootstrapping technique. The results showed that students who expressed a favourable attitude towards digital problem solving demonstrated a better level of competence, which was also positively influenced by the possession of technological devices and the frequency of their use for school and non-school activities at home.

Keywords DIGITAL TECHNOLOGY, DIGITAL SKILL, COMPULSORY EDUCATION, PROBLEM SOLVING

Received 2021-06-03
Revised 2021-06-11
Accepted 2021-07-13
Published 2022-07-15

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DOI https://doi.org/10.7821/naer.2022.7.789
Pages: 168-185

Funding: Ministry of Economy and Competitiveness, Spain (Award:EDU2015-67975-C3-3-P)

1 INTRODUCTION

Digital technologies (DT) are present in almost every social sphere and are being widely introduced as agents of change in educational practices . The new global scenario created by the COVID-19 pandemic has changed the context of education, revealing the importance of technology in the development of teaching and learning processes (Sá & Serpa, 2020). In recent years, digital competence has become an object of interest in the area of social science research and the new scenario has led it to become an area of particular concern in education policies (Cabero-Almenara & Palacios-Rodríguez, 2021) .

In the European context, digital competence is understood as a key competence in life-long learning, and it is defined as follows:

> The confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.
>
> *(European Union, 2018, p. 9)*

There are different assessment models to evaluate this competence, one of the most relevant being the Framework for Developing and Understanding Digital Competence in Europe (DigComp 1.0) (Ferrari, 2013), subsequently updated as the Digital Competence Framework for Citizens in 2016 (DigComp 2.0) (Vuorikari, Punie, Carretero, & Van Den Brande, 2016) and 2017 (DigComp 2.1.) (Carretero, Vuorikari, & Punie, 2017). According to this model, digital competence is structured into five areas (information, communication, content creation, safety, problem solving), three levels (foundation, intermediate, advanced) and three dimensions (knowledge, skills, attitude). Taking this model as a reference, the study presented is focused on the area of problem solving, whose digital competence dimensions are (a) solving technical problems; (b) identifying needs and technological responses; (c) innovating and creatively using digital technologies; (d) identifying digital competence gaps.

Research on the assessment of digital competence in young people has drawn increasing interest in the last decade, revealing significant gaps and shortcomings in the area (Casillas-Martín, Cabezas-González, & García-Valcárcel, 2020; Chen & Hu, 2020; George-Reyes & Avello-Martínez, 2021; Müller & Varga, 2020). Besides the influence of different variables such as gender, age or access to technology on the acquisition of this competence has also been studied (Basantes-Andrade, Cabezas-González, & Casillas-Martín, 2020; Cabezas-González, Casillas-Martín, & García-Peñalvo, 2021; Lucas, Bem-Haja, Siddiq, Moreira, & Redecker, 2021; Siddiq & Scherer, 2019).

There is scientific evidence of the influence of factors associated with owning technological devices, the use of digital applications or the characteristics of the family unit on the development of digital competence (Almerich, Suárez-Rodríguez, Díaz-García, & Orellana, 2020; Kim, Hong, & Song, 2018).

According to the latest report of the National Institute of Statistics on the equipment and use of information and communication technologies in households (INE, 2020), the use of computers by minors is very high (91.5%), the use of the Internet being even higher (94.5%). Conversely, 69.5% of them own a mobile phone.

Access to digital devices at home, frequency of use and their implementation to complete school tasks improves competence level (Almerich, Díaz-García, Cebrián-Cifuentes, & Suárez-Rodríguez, 2018; Chaudron, Gioia, & Gemo, 2018; García-Martín & Cantón-Mayo, 2019; Marsh, Hannon, Lewis, & Ritchie, 2017).

Likewise, family plays an essential role in the school life of children and youth (Miranda, Oriol, Amutio, & Ortúzar, 2019; Murillo & Hernández-Castilla, 2020) and certain studies

conclude that digital life as part of the family routine is one of the variables that most influence minors' digital competence (Montenegro, Raya, & Navaridas, 2020; Sánchez-Antolín, Andrés-Viloria, & Paredes-Labra, 2018), even more than the school context itself (Vila-Couñago, Regueira, & Pernas-Morado, 2020). However, there are studies that prove families' scarce understanding of the use of DT for educational purposes, since the use of technology in the household is usually associated with leisure and entertainment activities (Hortigüela-Alcalá, Pérez-Pueyo, López-Aguado, Manso-Ayuso, & Fernández-Río, 2020).

Regarding the relationship between reading habits and digital competence, research on the influence of technology when learning how to read (Bunting, Segerstad, & Barendregt, 2021; Li & Wah-Chu, 2020) shows that access to and moderate use of DT resources is positively associated with reading performance, while excessive use has a negative impact (Gubbels, Swart, & Groen, 2020). There is also evidence of the relationship between systematically and intensively using special support digital programs and the improvement of reading performance in youth (Björn & Svensson, 2021). Furthermore, Li and Wah-Chu (2020) have demonstrated how a gamified reading platform helps to increase pleasure in reading and reading skills in primary education school children.

In this context of in-depth study of the relationship between variables that have an impact on minors' digital competence level, the purpose of this research is to define how variables related to family and use of technology influence schoolchildren's competence in the problem-solving arena. This is achieved by using mediation models to find and contrast theoretical explanations that may help to understand the influence of certain variables over others, and moderation models to define the direction and strength of the relationship between variables according to the influence of a moderator variable.

The attitudinal component is also analyzed for this purpose, considering that attitude is a cognitive construct expressed through opinions and that it predisposes individuals to certain actions (Tejedor, García-Valcárcel, & Prada, 2009). In most of the studies on DT, the sample population's attitude towards them is positive (Basilotta, García-Valcárcel, Casillas-Martín, & Cabezas-González, 2020; Vila-Couñago et al., 2020), although there is some controversy regarding their relevance in the development of digital competence. While certain authors believe that the attitudinal component is relevant) (Cabanillas García, Luengo González, & Torres Carvalho, 2019), others do not (Arango et al., 2020).

2 MATERIAL AND METHODS

The study uses a quantitative method with a cross-sectional design that is based on an objective test and a scale of attitudes.

The overall objective of the research is approached through the use of mediation models to relate attitudinal factors, technology user habits and family variables to the digital problem-solving competence level of compulsory education students (aged 12-14).

The specific objectives of the study are:

1. To analyze the influence of students owning and using digital devices on the acquisition of digital competences in the area of problem solving.
2. To analyze the influence of students owning and using digital devices on the performance of school and non-school tasks at home.
3. To analyze the influence of students' attitudes towards problem solving on their competence level.
4. To analyze the influence of family conditions and reading habits on the acquisition of digital competences in the problem-solving arena.

The theoretical bases stated lead to the formulation of three hypotheses:

- Hypothesis 1. The digital problem-solving level of schoolchildren who own a larger number of technological devices will increase according to the frequency of use of such devices.
- Hypothesis 2. The competence level of schoolchildren who display a favorable attitude towards digital problem solving will be higher, the owning of technological devices and frequency of their use will have a positive influence on the performance of school and non-school activities at home.
- Hypothesis 3: The competence level of schoolchildren who display a more favorable attitude towards problem solving will be higher, family conditions and reading habits having a positive influence.

The research was conducted in education centers belonging to two provinces of the Autonomous Community of Castile and León (Spain), the purpose being to gather information from students who were about to complete or who had just completed primary education, selecting a student sample from the 6^{th} year of primary education and 1^{st} year of compulsory secondary education. The estimated population was 7653 schoolchildren (4175 primary education and 3478 secondary education students). The sample was calculated with a confidence level of 99% so that it could represent the reference population. The size required for such proportions was 611 students and stratified random sampling was used, considering rural/urban and subsidized centers, to achieve a final sample of 722 students and 18 education centers, exceeding the required sample size. All the participating students, who belonged to the selected academic levels and centers, had obtained permission from their family and had freely decided to participate in the study. Data cleansing was performed in the analysis, removing cases where students had left items of the questionnaire unanswered, which were exceptional.

The students who participated in the research have different digital devices at home, which makes it easier for them to access content available on virtual platforms and social media. Most of them own a digital music device (91.7%), a computer (91.2%), a tablet (82%) or a videogame console (68%). Significantly fewer own a mobile phone (39.2%), perhaps because of their age.

The digital competence assessment tool was designed using an item bank based on a previously designed and validated indicator model (INCODIES®, available from García-Valcárcel et al., 2019a; García-Valcárcel, Casillas-Martín, & Basilotta, 2020). The knowledge and skills dimensions were assessed using an objective test consisting of 16 items that presented situations where the students had to make decisions, selecting the right answer out of four possible options. Attitude was assessed using a 6-point Likert scale and personal and family-related data was collected by means of a 17-item survey.

The assessment test was purified through revision by a panel of expert judges and given to a sample of 288 compulsory education students. The results obtained were used to design the final test (Table 1), named ECODIES® (available from García Valcárcel et al., 2019b).

Table 1 Structure of the final assessment test in the area of problem solving.

Area	Number of items per competence dimension			Number of items per competence level		
	Knowledge	Skills	Attitude	Foundation	Intermediate	Advanced
A5. Problem solving	7	9		3	9	4
5.1. Solving technical problems	2	2		0	3	1
5.2. Identifying needs and technological responses	2	2		2	1	1
5.3. Innovating and creatively using digital technologies	1	3		1	2	1
5.4. Identifying digital competence gaps	2	2	6	0	3	1

After obtaining the relevant permissions from the authorities of the Educational Administration and the Ethics Committee of the University of Salamanca, implementation was conducted using a website designed ad hoc (https://www.ecodies.es/). All the education centers collaborated voluntarily and undertook the task of obtaining permission from the families and children and of implementing the test during school hours, always according to the guidelines and protocols established by the researchers.

Four types of variables were studied:

1. Dependent variable: Level (foundation, intermediate or high) of digital competence (knowledge and skills) in the problem-solving area (LDPS), of compulsory education students.
2. Independent variables: (a) Availability of devices (AD) defined as the number of technological devices (mobile phone, tablet, computer, videogames console, television) they have at home; (b) attitude towards digital problem solving (ATTITUDE).
3. Mediating variables. Four variables were used as potential mediators in the models: (a) Weekly frequency of use (FUSEWEEK) and frequency of use during the weekend (FUSEWEEKEND), defined in days and hours; (b) weekly frequency of use of technology to perform school and non-school related tasks at home.
4. Moderating variables: (a) family conditions (FC), defined by family structure (lives with mother, father or both) and doing activities as a family (both as indicators of coexistence in the family unit). These two variables were chosen after a review of the literature on relevant socio-familiar variables in the acquisition of digital competence,

(b) reading habits (RH), defined by: pleasure of reading and reading of books that are not related to school tasks.

The aim of the models is to verify the influence of the independent variables on the dependent variables via mediating and moderating variables.

Finally, as regards data analysis, multilevel models and mediation and moderation analyses were used to define the impact of variables related to attitudinal factors, technology use or family on the results of the assessment of the students' digital competence in the area of problem solving. The hypotheses proposed were tested using regression analysis with PROCESS v.3 macro for SPSS v.25 (Hayes, 2018). This software works as an extension of SPSS and enables regression analysis by means of the creation of theoretical models of reference. This tool allowed the possibility of testing different mediation models based on the bootstrapping technique and was also used to calculate the effect of the independent variables based on the calculation of the indirect effects. The results of the mediation between the different variables are presented as total effects (c_1 and c_2), direct effects (c'_1 and c'_2) and indirect effects ($a'b_1$, $a'b_2$, $a'd_1b_2$…). Indirect effects were analyzed using 10,000 bootstrap samples, generating bias-corrected bootstrap confidence intervals. Specifically, three models were proposed: two mediation models and a moderation model (Hayes, 2018).

The exploratory and predictive nature of the research led to the choice of regression analysis using multilevel models as opposed to the more traditional covariance-based structural equations model (Hair, Hult, Ringle, & Starsted, 2017; Nitzl, 2016), as has already been conducted in other studies (e.g., Bolkan et al., 2017).

3 RESULTS

The models proposed yielded the following results.

3.1 Use of Technology Factors

The influence of use of technology was tested through mediation analysis using model 6 (Hayes, 2018), understood as a group of two or more causal variables chained in sequence (X/M/Y), so that the mediating variable (M) be causally located between X and Y, and must be affected by X, which, in turn, must affect Y.

Hypothesis 1 proposes a mediation model aimed at understanding the influence of the availability of technological devices on the level of digital problem solving according to frequency of use both during the week and over the weekend, the latter operating as mediating variables (M) of the effect of similarity (Figure 1).

In view of the data, it can be said that there are variables that affect the level of digital competence in the area of problem solving.

Availability of devices at home (independent variable) has an impact on the acquisition and development of this competence. Moreover its mediating effect on frequency of use of devices during the weekend is highly significant (B = 0.051; SE = 0.014, p=0.0004) (Table 2).

Frequency of use of devices during the week is significantly affected both by availability of devices (B = -0.147; SE = 0.027, p=0.000) and by frequency of use of them over the weekend

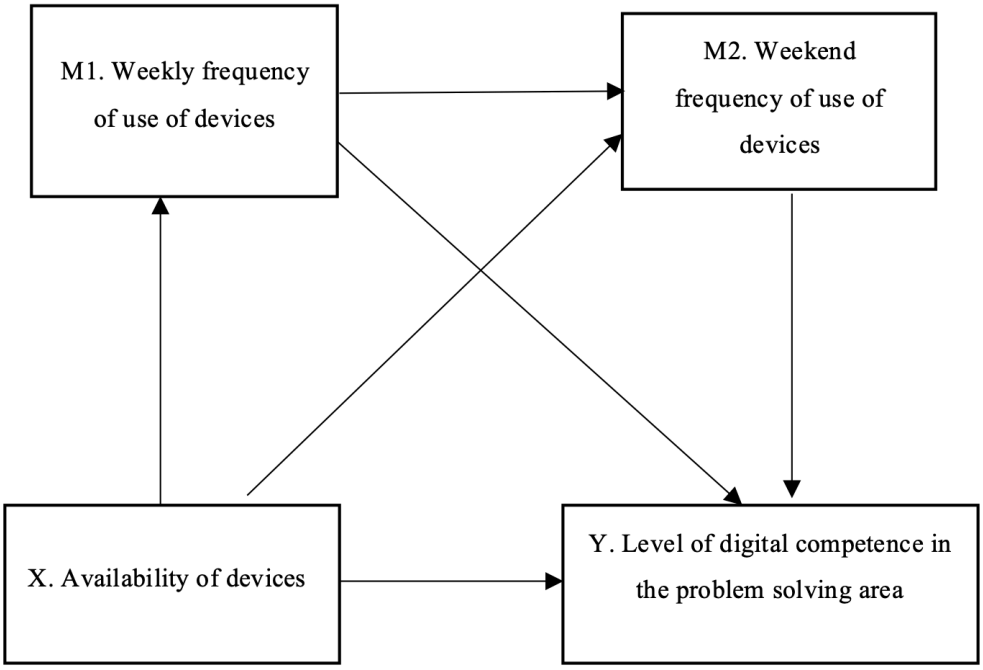

Figure 1 Conceptual diagram of a multiple mediator model with two differentmediators. Mediation model 6 (Hayes, 2018)

(B=-0.348; SE= 0.067, p= 0.000) (Table 3). It can, therefore, be understood that having a greater number of technological devices at home has a highly significant impact on the frequency with which they are used, both on weekdays and at the weekend.

Table 2 Mediation analysis. Relationshipbetween independent variable and FUSE-WEEKEND mediating variable.

WEEKENDFUSE	B	SE	t	p	LLCI	ULCI
constant	-0.031	0.086	-0.357	0.720	-0.200	0.138
AD→ FUSEWEEKEND	0.051	0.014	3.538	0.0004***	0.022	0.079
Standardized coefficients	B					
AD	0.126					

Note: FUSEWEEKEND: Frequency of use of devices duringthe weekend. AD: Availability of devices in the household. ***p<0.001

Although availability of devices has an influence on frequency of use, the level of digital competence in the area of problem solving is not significantly determined by having a larger number of devices (B = 0.072; SE = 0.058, p=0.211), nor by the frequency with which they are used during the weekend (B = -0.146; SE= 0.143, p= 0.307) and during the week (B = -0.029; SE = 0.075, p= 0.693) (Table 4).

The results show that there is a total effect on the proposed model (B= 0.070; SE= 0.056; p=0.215, IC 95% [-0.041, 0.181]), which means a positive, though not significant, influence

Table 3 Mediation analysis. Relationship of independent variable with FUSEWEEKENDand FUSEWEEK mediating variables.

FUSEWEEK	**B**	**SE**	**t**	**p**	**LLCI**	**ULCI**
constant	3.009	0.161	18.593	0.000***	2.691	3.327
AD→ *FUSEWEEK*	-0.147	0.027	-5.400	0.000***	-0.201	-0.093
FUSEWEEK → *FUSEWEEKEND*	-0.348	0.067	-5.165	0.000***	-0480	-0.215
Standardized coefficients	**B**					
AD	-0.188					
FUSEWEEKEND	-0.180					

Note: AD: Availability of devices in the household.FUSEWEEK: Frequency of use of devices during the week. FUSEWEEKEND: Frequencyof use of devices during the weekend. ***p<0.001

Table 4 Mediation analysis. Relationship dependent v. with independent v. andwith FUSEWEEK and FUSEWEEKEND mediating v.

LDPS	**B**	**SE**	**t**	**p**	**LLCI**	**ULCI**
constant	6,176	0.407	15.153	0.000	5.376	6.976
AD→ **LDPS**	0.072	0.058	1.251	0.211	-0.041	0.187
FUSEWEEKEND → **LDPS**	-0.146	0.143	-1.021	0.307	-0.428	0.135
FUSEWEEK→**LDPS**	-0.029	0.075	-0.394	0.693	-0.177	0.118
Standardized coefficients	**B**					
AD	0.046					
FUSEWEEKEND	-0.037					
FUSEWEEK	-0.014					

Note: LDPS: Level of digital problem solving. AD: Availability ofdevices in the household. FUSEWEEK: Frequency of use of devices during theweek. FUSEWEEKEND: Frequency of use of devices during the weekend.

of the two mediating variables (frequency of use of devices during the weekend and during the week). It can also be established that the effect of availability of digital devices on the level of digital competence in the area of problem solving is not significant (B = 0.072; SE = 0.058; p= 0.211, IC 95% [-0.041; 0.187]), so that there is no direct link between the dependent and the independent variable (Table 5).

Table 5 Total effect on the model, direct effect betweendependent and independent variable and indirect effects.

Total effect of X on Y	**B**	**SE**	**t**	**p**	**Boot 95% CI**
AD → FUSEWEEK → FUSEWEEKEND → LDPS	0.070	0.056	1.240	0.215	[-0.041, 0.181]
Direct effect of X on Y	**B**	**SE**	**t**	**p**	**Boot 95% CI**
AD → LDPS	0.072	0.058	1.251	0.211	[-0.041, 0.187]

There are three indirect effects (bootstrapping) in the interrelationship between variables: indirect effect 1. a1b1 (ind1): X→M1→Y (B=-0.007, SE=0.007, 95% CI [-0.023; 0.006]); indirect effect 2. a2b2 (ind2): X→M2→Y (B=0.004, SE=0.011, 95% CI [-0.017; 0.027]); indirect effect 3. a1d21b2 (ind3): X→M1→M2→Y (B=0.000, SE=0.001, 95% CI [-0.002; 0.003]. This data shows that there is no significant indirect effect when these variables

relate to one another, not having an influential impact on the level of competence in digital problem solving. The contrasts resulting from the comparison between the two mediators proposed in the model are not significant in any case (Table 6).

Table 6 Contrasts comparing the two mediators.

	B	SE	Boot 95% CI
(C1) AD → FUSEWEEKEND → LDPS	-0.007	0.007	[-0.023; 0.006]
(C2) AD → FUSEWEEK → LDPS	0.004	0.011	[-0.017; 0.027]
(C3) AD → FUSEWEEK à FUSEWEEKEND → LDPS	0.000	0.001	[-0.002; 0.003]

3.2 Attitudinal Factors

Hypothesis 2 was tested through a mediation analysis using model 81 (Hayes, 2018). The purpose was to verify whether attitude affects the level of digital problem solving, mediated by availability of devices and frequency with which they are used to perform school and non-school activities at home (Figure 2).

The proposed model shows that certain variables affect competence level. Attitude towards digital problem solving (independent variable) is significantly mediated by availability of devices (B= 0.033; SE= 0.012, p=0.006) (Table 7). Frequency of use of devices for the performance of non-school activities at home (Table 8) is not significantly affected by students' attitude (B= -0.000; SE= 0.005, p=0.946), although it is affected by availability of devices (B= 0.154; SE= 0.016, p=0.000).

Frequency of use of devices to perform school activities at home (Table 9) is significantly affected by attitude towards digital problem solving (B= 0.036; SE= 0.014, p=0.014). Likewise, availability of devices to perform school activities at home is one of the variables that has a significant effect on the frequency of use (B= 0.196; SE= 0.043, p= 0.000).

Table 7 Mediation analysis. Relationship independent variable with AD mediating-variable.

AD	B	SE	t	p	LLCI	ULCI
constant	4.940	0.311	15.881	0.000***	4.330	5.551
ATTITUDE → AD	0.033	0.012	2.737	0.006***	0.009	0.057
Standardized coefficients	**B**					
ACTITUD	0.098					

Note: AD: Availability of devices in the household. ATTITUDE: Students' attitude towards digital problem solving. ***p<0.001

Nonetheless, the level of digital competence in the area of problem solving (Table 10) is not significantly determined by availability of technological devices (B = 0.022; SE = 0.059, p=0.701), nor by frequency of use to perform school tasks (B= 0.038; SE= 0.046, p= 0.406) or non-school activities at home (B= 0.034; SE= 0.124, p= 0.781). Significant differences are only found in the attitude towards the digital problem-solving variable.

The results show that total effect is established in the proposed model (B= 0.115; SE= 0.018; p=0.000, CI 95% [0.078, 0.152]), which indicates a highly positive and very significant

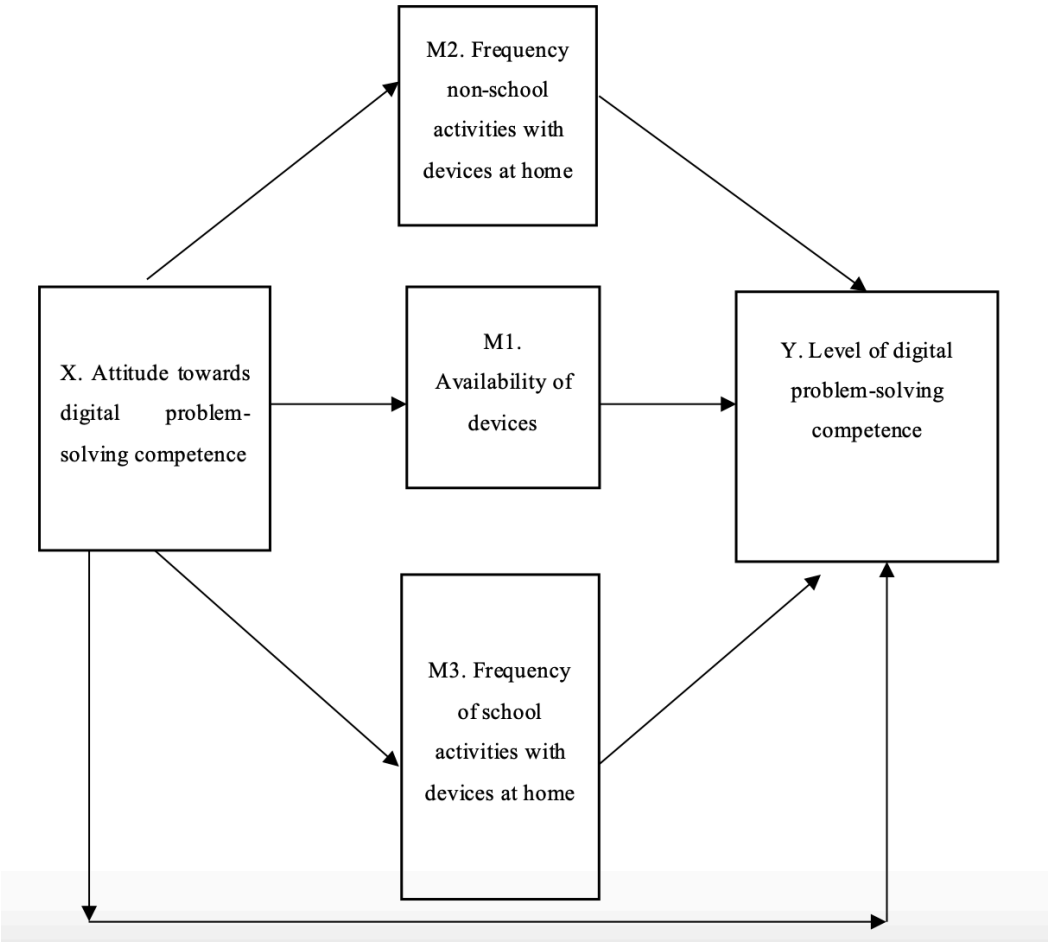

Figure 2 Conceptual diagram of a multiple mediator model with three differentmediators. Mediation model 81 (Hayes, 2018)

Table 8 Mediation analysis. Relationship independent variable with FREQNONSCHOOLACTmediating variable.

FREQNONSCHOOLACT	**B**	**SE**	**t**	**p**	**LLCI**	**ULCI**
constant	1.545	0.162	9.524	0.000***	1.226	1.863
ATTITUDE →*FREQNONSCHOOLACT*	-0.000	0.005	-0.067	0.946	-0.011	0.010
AD → *FREQNONSCHOOLACT*	0.154	0.016	9.449	0.000***	0.122	0.186
Standardized coefficients						
ATTITUDE	-0.002					
AD	0.324					

Note: ATTITUDE: Students' attitude towards digitalproblem solving. FREQNONSCHOOLACT: Frequency of non-school activities withdevices at home. FREQSCHOOLACT: Frequency of school activities with devices athome.

Table 9 Mediation analysis. Relationship independent variable with FREQSCHOOLACT-mediating variable.

FREQSCHOOLACT	**B**	**SE**	**t**	**p**	**LLCI**	**ULCI**
constant	0.340	0.434	0.785	0.432	-0.511	1.193
ATTITUDE →*FREQSCHOOLACT*	0.036	0.014	2.440	0.014**	0.007	0.065
AD → *FREQSCHOOLACT*	0.196	0.043	4.502	0.000***	0.110	0.282
Standardized coefficients	B					
ATTITUDE	0.086					
AD	0.160					

Note: ATTITUDE: Students' attitude towards digitalproblem solving. FREQNON-SCHOOLACT: Frequency of non-school activities withdevices at home. AD: Availability of devices in the household. FREQSCHOOLACT:Frequency of school activities with devices at home. **p<0.01 ***p<0.001

Table 10 Mediation analysis. Relationship dependent v. with independent v. andwith AD, FREQNONSCHOOLACT and FREQSCHOOLACT mediating v.

LDPS	**B**	**SE**	**t**	**p**	**LLCI**	**ULCI**
constant	3.365	0.585	5.752	0.000***	2.216	4.513
ATTITUDE →**LDPS**	0.112	0.019	5.935	0.000***	0.075	0.150
AD→**LDPS**	0.022	0.059	0.383	0.701	-0.093	0.138
FREQNONSCHOOLACT → **LDPS**	0.034	0.124	0.277	0.781	-0.209	0.129
FREQSCHOOLACT → **LDPS**	0.038	0.046	0.830	0.406	-0.052	0.129
Standardized coefficients	**B**					
ATTITUDE	0.211					
AD	0.014					
FREQNONSCHOOLACT	0.010					
FREQSCHOOLACT	0.030					

Note: LDPS: Level of digital problem solving. ATTITUDE:Students' attitude towards digital problem solving. FREQNONSCHOOLACT: Frequencyof non-school activities with devices at home. AD: Availability of devices inthe household. FREQSCHOOLACT: Frequency of school activities with devices athome. ***p<0.001

influence. It also shows that attitude towards digital competence in the problem-solving area has a significant influence on competence level (B = 0.112; SE = 0.019; p= 0.000, CI 95% [0.075; 0.150]), thus establishing a direct effect between the dependent and the independent variable (Table 11).

Table 11 Total effect on the model, direct effect betweendependent and independent variable and indirect effects.

Total effect of X on Y	**B**	**SE**	**t**	**p**	**Boot 95% CI**
ATTITUDE → AD → FREQNONSCHOOLACT → FREQSCHOOLACT → LDPS	0.115	0.018	6.131	0.000***	[0.078, 0.152]
Direct effect of X on Y	**B**	**SE**	**t**	**p**	**Boot 95% CI**
ATTITUDE → LDPS	0.112	0.019	5.935	0.000***	[0.075, 0.150]

Note: ***p<0.001

There are five indirect effects (bootstrapping) in the interrelationship between variables: indirect effect 1. (ind1): X→M1→Y (B=-0.000, SE=0.002, 95% CI [-0.003; 0.005]); indirect

effect 2. (ind2): X→M2→Y (B=0.000, SE=0.000, 95% CI [-0.001; 0.006]); indirect effect 3. (ind3): X→M3→Y (B=0.001, SE=0.002, 95% CI [-0.001; 0.001]); indirect effect 4. (ind4): X→M1→M2→Y (B=0.000, SE=0.000, 95% CI [-0.001; 0.001]; indirect effect 5. (ind5): X→M1→M3→Y (B=0.000, SE=0.000, 95% CI [-0.000**;** 0.001]. According to this data, there are no significant indirect effects where these variables are related, meaning that they do not influence students' competence level. The contrasts yielded by the comparison of the mediators proposed in the model are not significant in any case (Table 12).

Table 12 Contrasts comparing the two mediators.

	B	SE	Boot 95% CI
(C1) ATTITUDE → AD → LDPS	0.000	0.002	[-0.003; 0.005]
(C2) ATTITUDE → FREQNONSCHOOLACT → LDPS	0.000	0.000	[-0.001; 0.001]
(C3) ATTITUDE → FREQSCHOOLACT → LDPS	0.001	0.002	[-0.001; 0.006]
(C4) ATTITUDE → AD → FREQNONSCHOOLACT → LDPS	0.000	0.000	[-0.001; 0.001]
(C5) ATTITUDE → AD → FREQSCHOOLACT → LDPS	0.000	0.000	[-0.000; 0.001]

3.3 Family Factors

Hypothesis 3 was tested through a moderation analysis using Hayes model 3 (2018). The assumption is a positive relationship between the attitude towards digital problem solving and competence level in this area, moderated by the students' family conditions and reading habits (Figure 3).

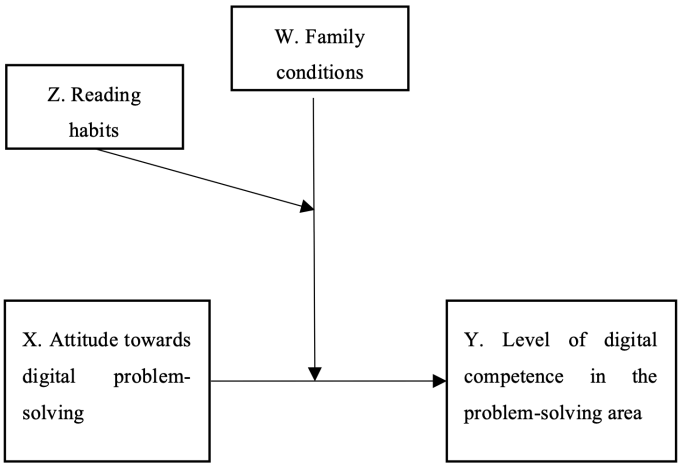

Figure 3 Conceptual diagram of a moderation model (Hayes' model 3, 2018)

The results obtained show that those who display a more positive attitude have a better level of digital competence, with highly significant differences (B= 0.287, p=0.011). However, it we compare competence level with family conditions (B=1.064, p=0.700) and reading habits (B= 4.121, p=0.188), although there is a positive relationship in both cases, it is not significant (Table 13)

Table 13 Moderation analysis. Relationshipindependent variable, dependent variable and FC and RH moderating variables.

LDPS	coeff	SE	t	p	LLCI	ULCI
constant	-1.145	2.823	-0.405	0.685	-6.686	4.397
ATTITUDE	0.287	0.113	2.534	0.011**	0.064	0.510
FC	1.064	0.700	1.519	0.129	-0.310	2.439
RH	4.121	3.134	1.315	0.188	-2.031	10.275

Note: **p<0.01

Considering students' family conditions, those who belong to families where conditions are more favorable (they live with both parents and share family activities) achieve better results in the digital competence assessment, although such differences are not significant. Likewise, those whose attitude is more positive achieve higher levels of digital problem-solving competence (Figure 4).

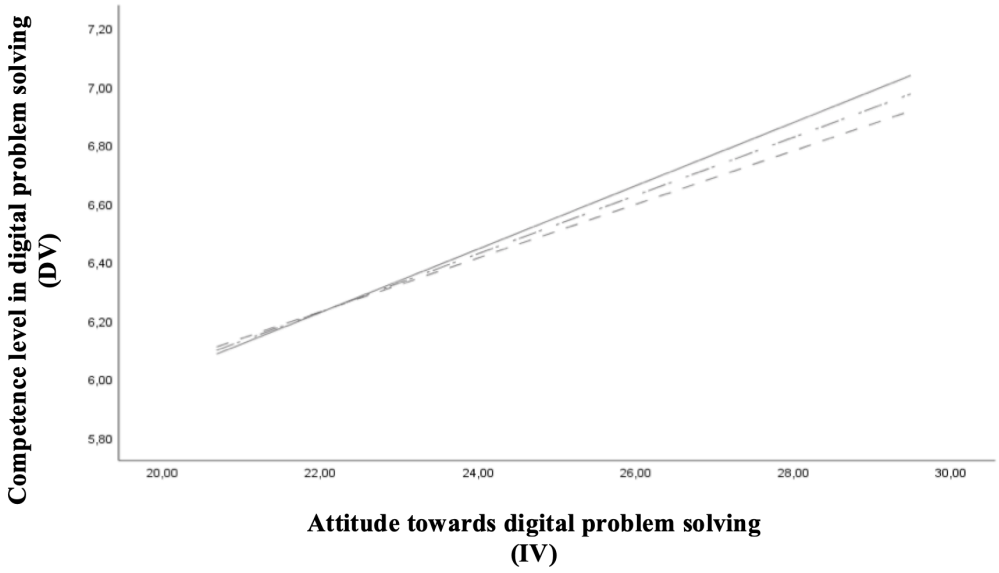

Figure 4 Moderation analysis graph: Relationship betweenattitude and digital competence according to family conditions.

4 DISCUSSION

Bearing in mind the factors associated with use of technologies, availability of technological devices at home has a highly significant influence on the frequency of use, which is consistent with other studies (ISEP, 2020). Nevertheless, this is not associated with competence level in the area of problem solving, where our results are in contrast with the findings of other studies that conclude that competence in DT improves with frequency of use both at the personal and at the academic level (Almerich et al., 2020; Baturay, Gökçearslan, & Ke,

2017), albeit they agree with other studies that state that exposure, use and coexistence with technological resources is not so relevant and neither does it involve the development of desirable levels of digital competence (Casillas-Martín & Cabezas-González, 2019; Colás, Conde, & Reyes, 2017).

Regarding attitudinal factors, attitude towards the competence area of problem solving is significantly defined by the availability of technological devices; however, it does not influence frequency of use to perform non-school activities at home but does so when performing school tasks. These results support the findings of other authors who claim that attitude is a relevant component in the development of digital competence (Albitres, Salinas, Bazan, Herrera, & Agüero, 2021; Cabanillas García et al., 2019; Pearson, 2018), compared to those who conclude that it is not (Arango et al., 2020).

In relation to family factors, the competence level of those students whose attitude is more favorable is better. However, the family conditions analyzed (single-parent or traditional family and shared family activities) and reading habits do not produce a significant effect. The results concerning family conditions are not consistent with those of other studies stating that students' previous experience with technology in their family context positively predicts their level of digital competence and their attitude towards the use of DT (Kim et al., 2018; Montenegro et al., 2020).

5 CONCLUSIONS

The health crisis caused by the Covid-19 pandemic has changed the educational context, increasing virtuality in the teaching and learning process. DT have acquired major importance and digital competence has become a necessity for students. Due to this, research aimed at providing explanatory data on the factors that may contribute to the acquisition of appropriate digital competence is essential. In this vein, our study has proposed mediation models that relate attitudinal factors, frequency of use of technological devices and family contexts to the aforementioned level of digital competence in the problem-solving area of students who are completing their primary education studies.

The first hypothesis posed, focused on factors related to use of technology, is rejected, since it can be concluded that students who have more devices and make greater use of them do not show better digital competence in the area of problem solving.

The second hypothesis, related to attitude, is accepted, since it is proven that students whose attitude is more positive show better digital competence and that the larger the number of devices, the greater the frequency with which they are used to perform school and non-school activities at home and the better the attitude towards the competence area of problem solving.

As regards the third hypothesis, which postulates that students who display a more favorable attitude towards solving digital problems will have a better competence level, family conditions and reading habits having a positive influence, it may be concluded that none of the two moderating variables has a significant effect. Therefore, the hypothesis is rejected.

Finally, it should be noted that the main limitation of this study is that the studied factors have contemplated specific variables that could hinder a more global and comprehensive explanation. It would be fitting to complete this work with a qualitative study of the examined factors.

ACKNOWLEDGEMENTS

R+D project "Evaluación de las competencias digitales de los estudiantes de educación obligatoria y estudio de la incidencia de variables socio-familiares" (Assessment of the digital competences of compulsory education students and study of the impact of social and family variables), funded by the Ministry of Economy and Competitiveness within the Excellence Sate Program for the Fostering of Scientific and Technological Research of the Spanish government (EVADISO, EDU2015-67975-C3-3-P, MINECO/FEDER).

Funded by: Ministry of Economy and Competitiveness, Spain

Funder Identifier: http://dx.doi.org/10.13039/501100003329

Award: EDU2015-67975-C3-3-P

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