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Technological Use, Didactic Intentionality and Attitudes towards Learning Mathematics with Technology in Public and Private School Students

Uso tecnológico, intencionalidad didáctica y actitudes hacia aprender matemáticas con tecnología en alumnado de escuelas públicas y privadas

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Abstract

Educational technology contributes to the improvement of the quality of education, playing a crucial role in the teaching of abstract content such as mathematics. This study sought to determine how the use of technology by teachers influences the perceived didactic intentionality of students and their attitudes towards learning mathematics with technology, considering whether these relationships vary according to the type of school (public or private). Using an explanatory design with latent classes, 1,326 Colombian schoolchildren (685 girls) were evaluated through a series of surveys. A Structural Equation Model was generated and showed good fit (CFI = 0.982, TLI = 0.966, RMSEA = 0.050), supporting the study hypotheses. Regression coefficients indicate that perceived didactic intentionality influences student attitudes in both educational contexts, but technological use has no relevant effect among public school students. The implications of the technological strategies employed by teachers to teach Mathematics and the intentionality perceived by their students are discussed, as well as the impact of contextual differences on the guarantee of an equitable educational service for students from diverse socioeconomic contexts.

Keywords: educational technologies; didactic intentionality; attitudes; mathematics.

Resumen

La tecnología educativa aporta a la mejora de la calidad formativa, cumpliendo un papel crucial en la enseñanza de contenidos abstractos como las matemáticas. Este estudio buscó determinar cómo el uso de tecnología por parte del personal docente influye en la intencionalidad didáctica percibida de los y las estudiantes y en sus actitudes hacia aprender matemáticas con tecnología, considerando si estas relaciones varían según el tipo de escuela (pública o privada). Mediante un

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diseño explicativo con clases latentes, se evaluó a 1326 escolares colombianos (685 chicas) por medio de una serie de encuestas. Se generó un Modelo de Ecuaciones Estructurales que demostró un buen ajuste (CFI = 0.982, TLI = 0.966, RMSEA = 0.050), respaldando las hipótesis de estudio. Los coeficientes de regresión indican que la intencionalidad didáctica percibida influye en las actitudes estudiantiles en ambos contextos educativos, pero el uso de tecnología no tiene un efecto relevante en las actitudes del alumnado de escuelas públicas. Se discuten las implicaciones de las estrategias tecnológicas empleadas por los docentes para enseñar matemáticas y la intencionalidad percibida por sus estudiantes, así como el impacto de las diferencias contextuales en la garantía de un servicio educativo equitativo para alumnos de diversos contextos socioeconómicos.

Palabras clave: tecnologías educativas; intencionalidad didáctica; actitudes; matemáticas.

Introduction

Despite the usefulness of technology in energising the teaching-learning process, its correct use to impact students' willingness to learn mathematics remains a challenge for many educators (Viberg et al., 2023). The effectiveness of educational technology does not depend solely on its availability, but on complex interrelationships between its use, the didactic intentionality of integrating it into pedagogical plans, and student attitudes. This constitutes a challenge for many educational environments, especially when access to technology can be affected by the socioeconomic level of schools (Ibáñez et al., 2020).

This study addresses this phenomenon in the Colombian educational context, which shows notable digital divides between schools in different regions (Sánchez et al., 2017) despite policies focused on technological literacy. Many efforts have prioritised strengthening infrastructure, while weaknesses related to capacities and skills for using technology persist (, Peña Gil et al., 2017). Specifically, this study focuses on the application of technologies in the educational context, with the aim of determining whether the use of technology to teach mathematics by teaching staff influences the didactic intentionality perceived by students, and whether both factors, taken together, positively affect student attitudes towards learning mathematics with technology.

Throughout the article, theoretical elements and empirical evidence related to the topic are presented, and at the end, the hypotheses derived from this review are listed. Each hypothesis will be announced in the context of the background review (e.g., "see Hypothesis 1") and then described at the end of the theoretical and empirical analysis. This facilitates consistency between the evidence discussed and the assumptions that guide the study, promoting a precise understanding of the reasoning behind each hypothesis.

Use of educational technologies and didactic intentionality in mathematics teaching

The use of educational technology refers to the application of specialised resources in the teaching-learning process to improve the quality of education, which depends on the teacher's technical competence, the value they attribute to technology for teaching, and the opinions of significant others (colleagues, superiors) (Lee et al., 2010). Using technology when teaching mathematics broadens the educational approach by integrating values, emotions, and beliefs (Monroy, 2024); it also promotes the development of skills such as problem solving, mathematical reasoning, and geometric thinking (Campo-Quintero, 2020). Technological mediation therefore becomes a necessity for educators and those interested in finding strategies that facilitate the understanding of mathematics.

The integration of technological resources seeks to increase student motivation by diversifying educational approaches, so their implementation should not be random or separated from pedagogical and disciplinary knowledge (Grisales, 2018). The use of these resources must respond to a didactic intention, which we assume to be the conscious and planned decisions of teaching staff to define pedagogical objectives that guide their students' learning. Therefore, educational content must be designed with a clear intention that facilitates student understanding (Souza et al., 2010).

However, the literature has questioned the lack of articulation between the use of technologies for teaching and didactic intent (Díaz et al., 2020), suggesting that the changes brought about by these innovations may not be generating a profound educational transformation (Casey et al., 2016). This limited success could be related to the lack of dialogue between research and teaching practice (Drijvers, 2019), leading to the use of technology in the classroom without regard for the recommendations derived from empirical studies.

In some cases, the pedagogical purpose is distorted because the technological resource becomes an end in itself, displacing its didactic usefulness with the intrinsic value of the artefact (Scott and Goldring, 2017). Experimental research has provided evidence that the use of technology *per se* does not transform thinking skills, but rather requires its integration with different teaching methods and techniques that enhance the technological contribution (Demir and Önal, 2021).

To a large extent, the success of using educational technologies lies in the ability to integrate the aims of the technology design in question with the design of tasks, activities and lessons by teaching staff (Drijvers, 2015). When such resources are used effectively in a constructive learning process, they help to establish connections between their educational intent and the results achieved by their students (Curwood, 2013). Considering the students' perspective is a priority, because although they recognise the advantages of studying with technology, literature reviews have reported that they also have fears and doubts, and even express the need for substantial assistance in the proper application of technological tools (Li, 2007). Many of them use more technology in their daily lives than in their school context, with its use being more common to reinforce traditional practices than to encourage novelty when studying mathematics (Bray and Tangney, 2017).

Viberg et al. (2023) evaluated a group of Swedish teachers and students, identifying that the latter perceived a disconnect between the use of digital tools and teachers' instructions, so they struggled with technology to complete assigned activities without adequate supervision. This suggests that teaching staff must understand the nature of the resources they use, along with their scope and possibilities, without losing sight of their responsibility in the educational process and in improving students' learning outcomes. This is more important than focusing solely on the possibilities offered by technology (Yurtseven et al., 2019).

This requires understanding how students perceive their teachers' didactic intentions, as they may not fully identify the purpose behind the resources used or designed by the educator (Jiménez-Tenorio et al., 2016). Therefore, it is important to consider students' interpretations of the teacher's intentions, which allows the educator to identify new meanings that could lead them to modify those originally attributed to the task (Sadovsky et al., 2015) (see Hypothesis 1).

Student attitudes towards learning mathematics with technology

In mathematics education, research has shown that incorporating technological strategies brings various benefits to teaching. According to the review of specialised works by Ran et al. (2022), the greatest effectiveness of technology in teaching mathematics is achieved when it is used in the design of collaborative learning environments that encourage interaction between students, mathematical problem solving, and the acquisition and development of concepts. Conversely, its effectiveness decreases when it is limited to supervision and assessment, especially if it lacks precise instructions for application and follow-up.

Different technology-based strategies and methodologies can have favourable effects on learning geometric coordinates (Saha et al., 2010), developing arithmetic skills in primary education (Shin et al., 2012), or increasing motivation to learn mathematical content when augmented reality is used (Poçan et al., 2023), among others. Likewise, technology creates a more attractive and enjoyable learning environment for students, which seems crucial for them to develop positive attitudes towards learning with technology (Demir and Önal, 2021). Attitudes are evaluations made about a psychological object, represented in evaluative polarities such as pleasant vs. unpleasant (Ajzen, 2001), which originate from the interaction of cognitive, affective, and behavioural components (Svenningsson et al., 2022). In this study, we assume attitudes towards technology to be a set of beliefs that, when linked to the emotions they generate, influence behaviour regarding their use.

A recent meta-analysis gathered evidence on the impact of technology on mathematics teaching. The results showed that its application positively affects the attitudes and motivation expressed by students at all school levels. The evidence indicated that attitudes towards mathematics benefit from interventions that apply various technological strategies, and such benefits were recorded in both short and long interventions (Higgins et al., 2019) (see Hypothesis 2).

Familiarity with technology also appears to be decisive in attitudinal response. In a quasi-experimental study, Eyyam and Yaratan (2014) implemented a technology intervention for Cypriot schoolchildren. Although the intervention improved mathematics achievement indicators, many students who preferred the technology-based class were not confident that it would help them succeed in the subject. The study attributes this uncertainty to the fact that the students had not had any previous contact with this type of teaching.

Similar results have been reported among American schoolchildren. With the aim of improving mathematical performance in the compulsory assessment in the state of Georgia (USA), an intervention was carried out with training in computer-mediated mathematical skills ( ). Although the intervention had no effect on the overall performance of the experimental group, a positive impact was observed in the subgroup of socioeconomically disadvantaged students (Brown, 2018). These findings suggest the importance of considering the socio-educational development contexts of students, as they may represent advantages or disadvantages for certain groups.

The findings described are relevant because they highlight the effect of economic conditions and access to educational technology. Although economically advantaged groups of students have greater access to technology, there is ambiguous evidence regarding students with fewer resources, with some studies indicating that the effect of technology on performance is similar to that found among students from higher socioeconomic strata (Li and Ma, 2010; Cheung and Slavin, 2013). For example, it has been found that augmented reality-based geometry interventions produce more effective results among Mexican students in public schools than among students in private schools. However, the latter group shows a higher level of motivation for technological activities (Ibáñez et al., 2020).

This highlights the importance of considering how inequalities in access to educational technologies could affect educational disparities between students from different socioeconomic backgrounds (Tan et al., 2017). It is therefore relevant to include an analysis of the phenomenon, taking into account the possible differences between access to public and private education and the role played by attitudes towards learning mathematics with technology (see Hypothesis 3).

The present study

The purpose of using educational technology has usually been analysed from the teacher's perspective. However, this study contributes to the field of study by exploring how teachers' use of technology influences the teaching intentions perceived by students, identifying whether these perceived intentions and the use of technology together contribute to the development of favourable attitudes towards learning. In addition, the study highlights that the effects between variables differ according to the type of school, indicating that the socioeconomic context affects the educational process.

Based on a review of the background, this study proposes the following hypotheses:

- H_1 . *The use of educational technology by teachers influences the didactic intentionality for teaching mathematics as perceived by students*.
- H_2 . *The use of educational technology and the didactic intent behind its implementation, as perceived by students, have a combined positive influence on student attitudes towards learning mathematics with technology.*
- H_3 : *The functional effects between teacher technology use, didactic intentionality perceived by students, and attitudes towards learning mathematics with technology vary depending on the type of school (public or private) that students attend.*

Method

Participants

Using an explanatory design with latent classes (Ato et al., 2013), a non-probabilistic accidental sample was selected. These samples are chosen according to availability and accessibility, following specific inclusion criteria (Neuman, 2014). For this study, it was stipulated that participants must be students between the ages of 14 and 19, enrolled in grades 8 to 11 within the formal school system in Colombia. They must also belong to educational institutions in the city of Barranquilla (Colombia), which is the largest urban centre in the Colombian Caribbean and the fourth largest economy in the country. The selection was made independently of gender or academic performance in four secondary education institutions, two in the public sector and two in the private sector.

The sample consisted of 1,326 Colombian students, divided into 641 males (48.3%) and 685 females (51.7%), aged between 14 and 19 years (M = 15.12, SD = 1.22). The average age of the boys was 15.17 (SD = 1.23) and that of the girls was 15.07 (SD = 1.22). According to the educational cycle in Colombia, the participants were in secondary school: 16.13% (n = 214) were in eighth grade, 20.59% (n = 273) in ninth grade, 32.58% (n = 432) in tenth grade, and 30.7% (n = 407) in eleventh grade. Additionally, 60.7% (n = 805) belonged to public schools and 39.3% (n = 521) to private institutions.

Instruments

Mathematics and Technology Attitudes Scale (MTAS) – Spanish version (Pierce et al., 2007). The translated, adapted and validated version was used with Colombian schoolchildren (Ávila-Toscano et al., 2025), in a sample similar to that recruited in this study. It consists of 14 Likert-type items (1 = *strongly disagree,* 5 = *strongly agree)* that measure three factors: Attitudes towards learning mathematics with technology (4 items [e.g., *Technological devices help me learn mathematics better]*, α = 0.874, ω = 0.874), Self-efficacy in mathematics (8 items [e.g., *I have a mathematical mind]*, α = 0.798, ω = 0.800), and Confidence in technology (3 items [e.g., *I do well using computers]*, α = 0.907, ω = 0.908). This adaptation for the Colombian population has adequate psychometric properties (χ^2/gl = 1.01, RMSEA[90% CI] = 0.014 [0.000, 0.036], SRMR = 0.49, CFI = 0.999, TLI = 0.999), ensuring its validity and reliability for the target sample.

Questionnaire for the study of attitudes, knowledge and use of ICT (ACUTIC, Mirete et al., 2015). Of the three constructs measured by the instrument, this study used the subscale focused on technology use, consisting of 12 items in which respondents indicate the frequency with which they use technological resources (1 = *never,* 5 = *always)*. The subscale is divided into two second-order factors called a) Daily and habitual use of technological resources and tools (e.g., *user tools and basic programmes such as Word, PowerPoint, etc.)*, *b*) Advanced academic use *(*e.g., *online educational resources such as translators, courses, podcasts, learning object repositories, etc.)*, each with six *items.*

In this study, a confirmatory factor analysis (CFA) was calculated using the sample data to ensure validity in the Colombian population. The results of the factorial model were favourable ($\chi(^2)$= 237.894, gl = 53, CFI = 0.992, TLI = 0.990, RMSEA[90% CI] = 0.051 [0.041, 0.058]; RMSR = 0.048). In addition, good internal consistency scores were identified for the global scale (α = 0.907, ω = 0.906), as well as for the subscales of regular use (α = 0.821, ω = 0.828) and advanced use (α = 0.847, ω = 0.850).

Questionnaire on the perception of teaching intentions. An *ad hoc* questionnaire was designed for the study, consisting of 20 Likert-type scale items (1 = *strongly disagree*, 5 = *strongly agree*). To test its performance, the sample was divided into two random sets, the first consisting of 657 participants (49.5%) to calculate Exploratory Factor Analysis (EFA), and the second consisting of 669 participants (50.5%) to perform CFA.

The EFA confirmed a good fit of the polychoric matrix (KMO = 0.963; Bartlet = 102104.063, p < .001) and led to the elimination of items 6 (*Capturing students' attention so that they show greater motivation and interest in the subject)* and 9 (*Organising the educational environment according to the needs and interests of students)*, due to their low factor loading (λ < 0.40). The items were grouped into two factors, the first consisting of 11 items (e.g., *Presenting lessons in an attractive way)* and called *Teaching-learning improvement (*α = 0.930, ω = 0.930). This factor determines the extent to which students perceive that the use of technology focuses on generating motivation, encouraging their participation in assessment, and making learning more dynamic.

The second factor consisted of seven items and is called *Application of technology with innovative intent* (α = 0.892, ω = 0.893). It focuses on identifying the extent to which students perceive the purpose of using technology in class as bringing them closer to digital resources and proposing a different kind of class (e.g., *developing learning activities in a way that differs from traditional teaching*).

The factorial model demonstrated appropriate levels of fit that guarantee the validity of the measure (χ^2= 178.793, df = 174, χ^2/df = 1.02; CFI = 0.999, TLI = 0.998, RMSEA [90% CI] = 0.022 [0.010, 0.031]; RMSR = 0.040). In addition, it recorded high overall internal consistency (α = 0.945, ω = 0.945). The questionnaire and factorial model can be accessed by contacting the lead author.

Procedure

Access to the sample was obtained with the consent of the educational institution authorities, who communicated the study's objective and protocol to the students' families. The research objectives were then shared with the students, who voluntarily agreed to complete the questionnaires. This process was carried out between August and November 2023, through the collective application of the instruments, which took an average of 20 minutes to complete. This study complied with an ethical protocol that incorporates the recommendations of the Declaration of Helsinki and the provisions of Law 1090 of the Republic of Colombia regarding the use of measurement and research instruments with human subjects.

Data analysis

Attitudes (ACT) were defined as an endogenous variable. This is the latent variable that we seek to explain and is composed of the manifest variables Attitudes towards learning mathematics with technology (AAMT), Self-efficacy in mathematics (AEM) and Confidence in technology (CUT).

Two exogenous variables were defined. The first was the use of educational technologies (USO), composed of the variables Daily and habitual use of technological resources and tools (UDH) and Advanced academic use (UAA). The second exogenous variable was Teaching Intentionality (TI), composed of the variables Improvement in Teaching-Learning (ITL) and Application of Technology with Innovative Intent (ATI). A fourth variable was the type of school (public or private), assumed to be a categorical exogenous variable used to explore whether the type of school attended by students can influence the relationship between the exogenous variables (USO and INT) and the endogenous variable (ACT).

Structural Equation Models (SEM) were constructed to test the functional effects between the variables. The multiple group method was used for this purpose, as the tested relationships were compared between students from public and private schools. The Mardia test indicated an absence of multivariate normality ($S = 4.262$, $x^{(2)} = 941.987$, $p < 0.001$; $K = 73.447$, $z = 16.945$, $p < 0.001$), opting to use the *Diagonally Weighted Least Squ*ares (DWLS) estimator, which is a robust estimation technique for data in which multivari normality is not assumed, as well as helping to reduce the influence of outliers by generating more reliable and valid models. In addition, errors were calculated using the robust method, which adjusts the standard errors of the coefficients to show robustness in the face of assumption violations, helping to minimise the influences of outliers or lack of normality.

The model fit was calculated using Chi-square (expected values not significant) and various indices, including: Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) (for both, acceptable values > 0.90 and good values > 0.95). The Root Mean Square Error of Approximation (RMSEA) (expected values < 0.08 with 90% confidence intervals) and Root Mean Square Residuals (SRMR) (acceptable values < 1 and good values < 0.05) were also calculated (Hu and Bentler, 1999; West et al., 2012). Data analysis was performed using JASP v.0.18.1 (JASP Team, 2023), through the SEM module that uses an interface based on the lavaan package of R (Rosseel, 2012).

Results

Table 1 shows both the descriptive information of the variables and the analysis of the bivariate relationships. Descriptively, the data reveal moderate levels of use of educational technologies in mathematics classes, with a slight advantage for those that are used daily and habitually, with a mean of 17.419 (SD = 5.884), compared to a maximum of 30. In terms of teaching intent, the perception that the technological resources used by teachers are focused on improving teaching and learning stands out, with an average of 52.315 (SD = 9.838), compared to a maximum score of 55.

Attitudes showed mixed results, with a better attitude towards learning mathematics using technology and confidence in it than self-efficacy in the discipline. In other words, the attitudinal response seems favourable, as does confidence in using technological means, but the personal assessment of their mathematical abilities is modest, with an average of 25.298 compared to a maximum possible score of 40.

The correlation analysis was performed using Spearman's coefficient and shows that the three attitudes evaluated are positively related to the two types of teaching intentions. In contrast, both daily and habitual use of technology and advanced academic use are related to mathematical self-efficacy and confidence in technology, but not to attitudes towards technology-mediated mathematics learning.

Table 1.

Descriptive behaviour and relationships between study variables.

	Bivariate correlations						Descriptives		Form measures	
Variable	UDH	UAA	AAMT	AEM	CUT	ME-A	M	DT	Asymmetry	Kurtosis
UDH	—						17,419	5,884	0.007	-0.772
UAA	0.801***	—					15.007	5.902	0.449	-0.482
AAMT	-0.050	-0.053	—				12.832	3,444	-0.173	0.348
AEM	0.165***	0.175***	-0.010	—			25,298	6,064	-0.469	-0.207
CUT	0.183***	0.175***	0.219***	0.266***	—		11.051	2,391	-0.433	0.006
ME-A	0.265***	0.257***	0.160***	0.273***	0.243***	—	52.315	9,838	-10,063	10,493
ATII	0.336***	0.298***	0.202***	0.168***	0.267***	0.729***	26,814	5,791	-0.855	0.639

***$p < 0.001$.

We tested whether it was plausible to consider the effect of school type on the performance of the variables analysed, comparing the scores of students from public and private schools. This analysis (Table 2) ruled out differences in daily and habitual use of technology, teaching intentions, and confidence in the use of technology. Although the latter obtained a p-value lower than 0.05, the difference was ruled out due to the absence of effect size ($d = 0.12 < 0.20$). The remaining attitudinal subscales and advanced academic use did show disparities between schools, with higher means among students in private institutions, except for the AAMT attitudinal subscale, which was higher among students in public schools. Therefore, there is a need to test functional relationships separately.

Table 2.

Comparison of study variables between students from public and private schools.

		Descriptives		Welch's t-test			Effect	95% CI Cohen's d	
	School	M	DT	t	gl	p	Cohen's d	Inf.	Sup.
UDH	Public	17,563	6,312	1,152	12,549	0.250	0.063	-0.047	0.174
	Private	17,198	5,152						
UAA	Public	15,511	6,301	4,056	12,560	< 0.001	0.223	0.112	0.334
	Private	14,228	5,134						
AAMT	Public	12,235	3,260	-7,904	10,492	< 0.001	0.448	-0.560	-0.336
	Private	13,754	3,518						
AEM	Public	26,084	5,801	5,850	10,485	< 0.001	0.332	0.220	0.443
	Private	24,083	6,264						
CUT	Public	10,933	2,462	-2,284	11,745	0.023 < 0.05	0.127	-0.238	-0.017
	Private	11,234	2,267						
ME-A	Public	52,627	9,792	1,433	11,014	0.152	0.081	-0.030	0.191
	Private	51,833	9,899						
ATII	Public	26,620	5,809	-1,519	11,175	0.129	-0.085	-0.196	0.025
	Private	27,113	5.755						

An SEM was generated by calculating the functional relationships between the variables, taking into account the possible effect of school type. This model obtained a significant Chi-square value ($x^2_{[22]} = 58.897$, $p < 0.001$), indicating that the model is different from the null model. However, it is necessary to note the sensitivity of Chi-square when large samples are used, so its interpretation should be cautious.

In fact, analysis of the other indices calculated suggests that the model fit is appropriate, since the indices presented values above the expected thresholds (> 0.95) (CFI = 0.982, TLI = 0.966). The RMSEA (.050, 90% CI = 0.035, 0.066) indicates that the model shows a reasonable to good fit, suggesting that the model is likely to correspond correctly with the population. In addition, an SRMR of 0.044 was reported, which is a low value suggesting that the modelled relationships between the variables accurately reflect the relationships observed in the data.

The regression coefficients obtained (Table 3) support the hypotheses formulated. On the one hand, functional effects between the variables are recorded (H_1 , H_2), and, in addition, there are variations that appear to be due to the effect of school type (H_3).

Table 3.

Regression coefficients of the SEM with multiple groups.

							95% CI	
Group	Predictor	Result	Estimator	SE	Z	p	Inf.	Sup.
Public	INT	ACT	0.053	0.014	3.767	< 0.001	0.025	0.080
	USO	ACT	0.011	0.008	1.348	0.178 > 0.05	-0.005	0.027
		INT	0.624	0.062	10.123	< 0.001	0.503	0.745
Private	INT	ACT	0.028	0.013	2.180	0.029 < 0.05	0.003	0.053
	USE	ACT	0.064	0.024	2.634	0.008 < 0.01	0.016	0.111
		INT	0.640	0.107	5.981	< 0.001	0.430	0.850

In contrast to the first hypothesis, in both groups the use of technology has an effect on teaching intent, while in relation to the second hypothesis, both the use of technology and perceived teaching intent influence the attitudes towards technology of students in private schools, with calculations accompanied by small p values (< 0.05) and estimators included in the confidence intervals, which do not cross the zero value. However, in public schools, although there is an effect of intentionality, the use of technology is not identified as having a positive effect on the attitudinal repertoire ($\beta = 0.011$, $p = 0.178 > 0.05$). These findings reinforce the assumption that the type of institution influences the configuration of functional relationships between the variables studied.

Figures 1a and 1b show the path diagram that collects all the functional relationships for each type of educational institution using standardised estimates. The coefficients obtained indicate that the use of technology is the variable with the greatest effect on attitudes in private schools, while in public schools, teaching intent is the variable that most influences attitudes. In both contexts, the use of technology has a positive effect on perceived teaching intent.

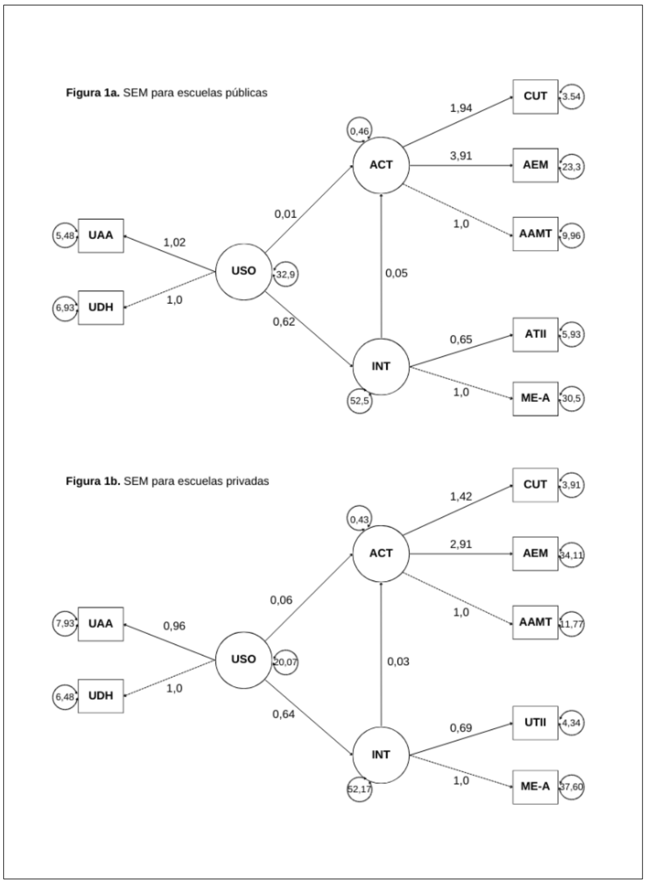

Figure 1. *Path diagram of the structural equation model.*

Discussion

In this study, we sought to determine whether the use of technology by teaching staff to teach mathematics influences the teaching intent perceived by students, and whether both (intent and use of technology) influence student attitudes towards learning mathematics with technology. We also sought to identify whether these effects varied according to the type of school (public-private).

Although the data reflect a trend toward the use of educational technology in the classroom, the reported use among participants from public and private schools is moderate, with a slight advantage in the use of common resources used in everyday life (such as social networks or search engines). It could be thought that teaching staff resort to mechanisms known to students to take advantage of the familiarity of certain resources as a motivational element, since in general, most students use technology for communication purposes and, to a lesser extent, as a pedagogical resource (Shabbir et al., 2020).

This reiterates previous evidence showing that, despite the growing penetration of technology in education, many teachers limit its application to instrumental activities (Cabero and Barroso, 2016; Valdivieso and Gonzáles, 2016), with a low level of complexity that hinders a real impact on learning. Technology is mainly used as a support resource to convey knowledge, expand explanations or carry out assessments (Abella-Peña and García, 2022), but without sufficient depth to generate real transformations in learning.

The results on didactic intentionality are of interest in this context, given that the descriptive analysis showed higher means in intentions focused on improving the teaching-learning process. These intentions reflect the teacher's decision to use technology to motivate students, involve them in their own assessment, and make learning more dynamic and meaningful. On the other hand, intentions related to the application of technology for innovative purposes ($M = 26.814$, $SD = 5.791$, out of a maximum of 35 points) focus on more practical purposes that are somewhat instrumental, aimed at presenting content in a more innovative way in class. In summary, the perceived intentions involve pedagogical planning, although the reported use of technology continues to be limited to common resources.

The low index of advanced academic resources suggests the need for teacher training in the use of relevant tools that are also linked to teaching objectives that are clearly communicated to students. Drijvers (2015, 2019) has emphasised that the successful use of technology for teaching mathematics requires proper preparation of teaching teams, who need to understand the pedagogical objectives behind the design of specific technological resources in order to plan the correct articulation of these resources with the training and assessment activities designed by the teaching team itself. Through this articulation, it is possible to avoid the risk of instrumentalising technology and losing its didactic usefulness, which would not contribute to the development of thinking skills (Demir and Önal, 2021; Scott and Goldring, 2017).

Such preparation also lies in developing pedagogical skills that ensure appropriate instruction, so that the use of technology does not become an additional burden for students (Viberg et al., 2020) but rather that they have adequate support from teachers to ensure understanding of concepts through the mediation of digital tools. We assume that this involves designing inclusive curricula that propose the use of technology as an integral part of instruction, tailored to student needs. This requires cooperation between teachers and curriculum designers to ensure that the use of technology is aligned with learning objectives (Drijvers, 2019).

The regression coefficients confirm the three hypotheses formulated. The use of technology influences teaching intent, and both factors together impact student attitudes, with variations between public and private schools. In addition, evidence related to student attitudes and technology use has contributed notable elements to the discussion. The comparative analysis revealed that, although students in public institutions show a greater willingness to use educational technologies, they also have lower mathematical self-efficacy, perceiving themselves as less competent than their peers in private schools. The latter, in turn, report higher levels of advanced academic use of educational technologies. It should be noted that, in public schools, the use of technology does not seem to have a significant impact on attitudes.

This finding partially coincides with previous studies, such as that of Eyyam and Yaratan (2014), who identified an improvement in attitudes among low-income students after their initial exposure to educational technologies. However, the results also differ to some extent from other research, which highlights a greater affective response (motivation) among students in private institutions (Ibáñez et al., 2020).

There seems to be some ambiguity in the literature regarding the impact of using technologies according to the socioeconomic status of students (Cheung and Slavin, 2013; Li and Ma, 2010). While in private institutions the relationship between the use of educational technologies and student attitudes is more clearly identified, the lack of influence in public schools may be caused by ineffective implementation or by the existence of context-specific barriers, such as the availability of resources or insufficient teacher training. Shabbir et al. (2020) reported that teaching staff in private schools have greater access to resources and better digital skills, which allows them to be more resourceful in their classes and in the organisation, development and planning of content. In contrast, in public schools, although teaching staff have technological resources, they often do not use them correctly.

Perceived didactic intentionality, meanwhile, influences the development of positive attitudes towards the use of digital resources for learning mathematics, regardless of socioeconomic context. This has several practical implications. On the one hand, it reinforces the importance of teaching staff planning their teaching with clear objectives that link technology with learning outcomes in order to achieve a better understanding of the content (Curwood, 2013; Souza et al., 2010; Yurtseven et al., 2019). On the other hand, it suggests that including student expectations and perceptions in educational planning when applying digital resources can help students to embrace technological resources positively, promoting their acceptance as a useful means of learning mathematics. Additionally, these results support the need to foster a culture of ongoing support, where teaching staff monitor their students' use of technology, ensuring feedback practices that stimulate self-efficacy both in technological mastery and in learning mathematics through digital resources.

It is necessary to point out some limitations that should be considered in the assessment of the results and their scope. In the absence of a validated instrument to measure educational goals, a tool was designed for this study, which, although it showed a favourable factorial structure, still requires further review and analysis that could lead to the validation of the measure. It is also important to consider the effect of other variables such as personal experience with technology, the limitations or facilities offered by the educational context, and even the contrast between the teaching objectives planned by teachers and what their students perceive. These variables can be a source of significant variations, even more so than the socio-economic conditions of educational institutions.

Finally, the limitations inherent in accidental sampling must be considered, especially when the sample is stratified by academic grade and groups within each grade. In this regard, future studies could address the phenomenon using hierarchical models that incorporate the variability associated with such stratification.

In conclusion, although many educators have a favourable view of technology and are willing to use it in their teaching practice, they need to align these motivations with effective knowledge that ensures proper articulation. It is crucial that teachers articulate their curriculum planning with their students' perceptions to ensure teaching practices that are in harmony with student interests. This implies that teachers receive the necessary training in the use of educational technologies, understanding that their application is not limited to access to devices or software, but rather that requires strategies consistent with pedagogical plans, ensuring effective support for their students. In this endeavour, access to educational transformations through technology is a social responsibility for teachers and institutions in the public and private sectors, ensuring equitable service with practices tailored to improve educational outcomes.

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