

Do computers! Internet! etc. give confidence to students while doing mathematical tasks?

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Suggested citation: Eskici, M. & Serin Erel, N. (2025). Do computers! Internet! etc. give confidence to students while doing mathematical tasks? *Journal of Educational Technology and Online Learning*, 8(4), 473-489

Highlights

- This study demonstrates that having a computer and educational software and applications that students can use for homework significantly differed in favor of students who had access to computers, educational software, and applications for performing mathematical tasks. effectiveness
- Having a mobile phone with internet access and wireless internet at home significantly differed in favor of students who had access to a mobile phone with internet access and wireless internet at home in some of the 10 questions related to performing mathematical tasks.
- The impact of students' access to internet-enabled mobile devices and home Wi-Fi on their perceptions of confidence in mathematical tasks was more limited compared to other types of technology access.

Abstract

This study aims to determine whether students from Turkey participating in the PISA 2022 survey feel confident using technology while performing mathematical tasks. In this study, 10 questions regarding feeling confident while performing mathematical tasks in the PISA 2022 survey and students' responses to questions concerning access to technological resources (e.g., computer, home wireless internet, mobile phone with internet, educational software, and applications). The Mann-Whitney U test was employed to analyze the PISA 2022 SPSS dataset. The analysis showed that having a computer and educational software and applications that students can use for homework significantly differed in favor of students who had access to computers, educational software, and applications in all 10 questions related to performing mathematical tasks. Having a mobile phone with internet access and wireless internet at home significantly differed in favor of students who had access to a mobile phone with internet access and wireless internet at home in some of the 10 questions related to performing mathematical tasks.

Article Info: Research Article

Keywords: *Mathematical Tasks, PISA 2022, Computer, Internet*

1. Introduction

Mathematics is a fundamental branch of science that develops individuals' reasoning skills and analyzes logical structures through a universal system of symbols and terminology. Mathematics education equips students to understand real-world problems and develop rational solutions to these problems. The process

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This study was partly presented as a proceeding at the 5th International Conference on Educational Technology and Online Learning held between 26-29 August 2025.

of learning mathematics supports the holistic development of cognitive skills, such as problem solving, reasoning, connections, and representation (NCTM, 2000). The opportunities offered by technology enrich mathematics teaching, enabling abstract concepts to be concretized and enhancing students' depth of understanding (Attard & Holmes, 2022; Engelbrecht et al., 2020).

As noted by Devlin (2019) and Hidayet & Wardat (2024), using technology in teaching subjects, such as mathematics, engineering, and physics, offers a solution to the expensive educational environments required. Furthermore, Bickerton & Sangwin (2021) emphasize the significant advantage of using technology in the mathematics assessment process. This will also enable students to self-assess with the support of technology (Gonscherowski & Rott, 2023).

A study by Richard et al. (2023) indicates that implementing artificial intelligence into educational environments has made international interdisciplinary collaborations in mathematics education possible. In an era of such technological advancements, the task of mathematics educators is to imagine how technology can be used for the most effective teaching (Pelton & Pelton, 2024; Frey, 2022). In particular, the use of artificial intelligence has made it much easier to implement skills, such as gamification, interactive competitions, collaboration, visual enrichment, data evaluation, and adjusting the difficulty level of education based on student performance in mathematics lessons (Cendros Araujo & Gadanidis, 2020; Graham, 2023; Pepin et al., 2025). Thus, students can gain awareness of mathematics learning and have the opportunity to organize their own teaching processes (Asare & Boateng, 2025; Menlah & Boateng, 2025). This situation makes artificial intelligence, especially ChatGPT, indispensable in learning an essential course, such as mathematics (Lestari et al., 2025; Zein et al., 2024).

2. Literature

The increasing use of technology in education has added new dimensions to the mathematics learning process (Engelbrecht & Borba, 2024). Computers, the internet, and smart devices facilitate the concretization of abstract concepts through educational software and applications and support learning. Research in the literature shows that technology-based applications make students' mathematics learning processes more enjoyable and increase their motivation (Esen & Karakuş, 2025; Higgins et al., 2019). Therefore, the use of educational technologies is considered an important element in strengthening students' self-confidence in mathematics.

Computers and digital technologies have become an important part of learning and teaching processes in the 21st century, and many lessons and activities are supported by these tools to improve student success and learning quality. Zawacki-Richter and Latchem (2018), examining the transformation of computer-assisted learning applications, state that in the forty-year literature, integrating technology with pedagogical design has become a fundamental condition for learning success. The researchers emphasize that computer use should be considered not only as a technical innovation but also as a pedagogical component requiring the restructuring of teaching processes. The literature shows that computer use can improve students' motivation, academic performance, and higher-order cognitive skills; however, the level of this effect is closely related to how technology is positioned pedagogically. A study by Özkale and Koç (2014) on the use of tablet computers in educational environments shows that digital tools increase interactivity, individualize learning, and enhance student interest in the lesson. Similarly, research by Genç, Güven, and Söğüt (2021) reveals that the use of computers and tablets in the context of science lessons has a positive impact, particularly on problem-solving, data interpretation, and scientific process skills. These studies demonstrate that computer use can potentially enhance learning. Teacher competence is a critical component of this process. Research by Dikmen, Akylı, and Akçay (2021) shows that teachers' self-efficacy perceptions regarding computer and internet use are directly reflected in classroom practices and support students' effective use of computers for learning purposes. This finding indicates that the effective use of technology depends not only on the student but also on the teacher's digital competence. However, there is also evidence that technology may not provide the expected contribution when used incorrectly, aimlessly, or without pedagogical support. An experimental study conducted in Colombia by Barrera-Osorio and Linden (2009) revealed that providing computers to schools alone did not improve students' academic

performance. The research showed that the mere physical presence of technology was insufficient; This emphasizes that for effective learning, computers should be systematically and pedagogically integrated into classroom activities. This shows that computer use yields positive results only when it is purposeful, teacher-guided, and consistent with the content. Research conducted by Bıyıklı and Bayat (2022) in a logistics management program showed that computer-based simulations improved decision-making and process analysis skills. Furthermore, research by Baylak, Özer, Küçükkürkücü, and Şimşek (2024) on the educational computer game CoğrafyaIQ revealed that educational digital games increased participation, supported conceptual learning, and contributed to students developing positive attitudes towards the course. When all these findings are considered together, it is seen that the impact of computer use in education is conditional, multidimensional, and sensitive to pedagogical design. In this context, how and for what purpose students use computers is a critical factor determining the effectiveness of computer-assisted learning. Becker (2000) showed that pedagogical motivations guiding students' computer use, particularly in problem-solving, discovery-based activities, and collaborative learning tasks, resulted in higher computer engagement. This study demonstrated that students' ability to acquire meaningful learning experiences depends on their use of digital tools in a way that aligns with learning objectives. Therefore, access to computers does not produce the expected effect unless it is supported by active and conscious use in learning processes. When technology is properly planned and supported by high-quality digital content, it can improve students' academic achievement; however, simply providing technology alone does not create an increase in learning. Therefore, students' ability to use computers effectively in education requires a holistic approach supported by high-quality content, teacher training, systematic integration, and digital literacy development. These findings regarding the context-sensitive nature of technology's impact on learning are also confirmed by experimental studies. In a randomized controlled experiment conducted in Colombia by Barrera-Osorio and Linden (2009), which examined the effect of providing computers on student achievement, it was found that distributing computers to schools alone did not significantly improve academic achievement.

The widespread use of the internet in educational settings significantly impacts students' attitudes towards learning processes, academic achievement, and safe internet use behaviors. Recent research indicates that internet use offers both significant opportunities and various risks for students. Therefore, understanding how, for what purposes, and with what competencies students use the internet is critical for evaluating its role in education.

Studies examining the internet usage patterns of middle school students reveal that the internet is used extensively for both educational and non-educational purposes. A study by Gökçearsan and Seferoğlu (2016) indicates that students use the internet for functional purposes such as homework research, information gathering, and communication; however, they also tend towards risky behaviors (sharing personal information, unconscious social media use, etc.). Similarly, a study by Kop and Yiğit (2017) emphasizes that although students use the internet for learning purposes, social media and online games have become the dominant areas of internet use. The findings of the research conducted by Beder and Ergün (2015) show that a significant portion of students lack safe internet use skills, and this is particularly evident at the middle school level. However, the digital divide remains a significant problem among middle school students, especially in socioeconomically disadvantaged areas, where students use the internet for limited purposes (Akca, 2014).

Studies addressing the use of the internet for educational purposes reveal that students have largely embraced this environment to support their learning processes. Kuzhan (2019) states that the internet has become a fundamental resource for students in terms of research, content learning, and access to academic information. Examinations within the context of educational programs and course content show that internet use has a supportive quality for learning when it is aligned with learning outcomes. For example, the study by Abide and Gelişli (2020) revealed that social studies textbooks are inadequate in terms of content learning outcomes related to safe internet use. This finding indicates that students' safe and conscious internet use is not adequately structured from a pedagogical perspective. In contrast, Taşyürek (2022) stated

that students' internet usage levels for social studies lessons enriched their learning experiences and that they participated more in in-class activities through the internet.

International research on internet usage among middle and high school students also reveals similar trends. Almasi, Machumu, and Zhu (2017) showed that internet use supports the academic performance of high school students, but the frequency and purposes of use are decisive factors in success. Yılmaz and Orhan (2010) stated that high school students widely use the internet for information searching, completing assignments, and accessing learning resources; and that students with a deep learning approach use the internet more effectively. However, it is also seen that internet use can lead to unequal results among students. Zhao et al. (2010) revealed that the internet usage experiences of high school students in different geographical regions vary and that this affects students' internet self-efficacy. Similarly, Ballesta-Pagán et al. (2018) state that the digital divide persists even in sustainable societies and that socioeconomic factors determine students' internet usage profiles. Oğur, Yılmaz, and Göktaş (2017) also showed that the internet usage habits of middle school students are quite heterogeneous and strongly influenced by their daily life practices.

The effects of internet use on self-efficacy and motivation are also an important research area in the literature. Tsai and Tsai (2010), by re-evaluating gender-based differences in internet self-efficacy, showed that constructive and conscious use of the internet increases digital self-efficacy. Yusof and Steinmueller (2022) emphasize that internet use among students in Indonesia has positive effects on their academic performance, but this effect is directly related to the quality of internet use. Tarimo and Kavishe (2017) revealed that students in regions where internet use is widespread develop higher levels of information literacy. In the study conducted by As and Eskici (2023), it was found that middle school students' use of the internet contributed to their overall academic performance.

Madden et al. (2005), examining teachers' views on internet use, stated that teachers were willing to incorporate the internet into the teaching process, but the lack of guidance, infrastructure, and content development support limited integration. This finding shows that internet use is closely related to teacher competencies as well as student competencies. It is seen that it affects learning processes in educational environments in a multidimensional way. The internet offers significant opportunities in terms of research, access to information, collaborative learning, and content enrichment; however, it also harbors potential problems such as unconscious use, security risks, and unequal access. Therefore, the effective use of the internet in education depends on developing students' digital literacy skills, increasing awareness of safe use, and designing pedagogically structured learning experiences.

The widespread use of computers and the internet, along with the integration of digital technologies into educational environments, particularly with the development of mobile applications, has begun to profoundly affect the learning processes of middle school students. Research shows that educational applications have the potential to support students' academic performance (Ababa et al., 2021; Alneyadi et al., 2023). In this process, the proliferation of mobile devices has expanded learning opportunities by enabling students to access course content anytime and anywhere (Karabatzaki et al., 2018; De La Cruz et al., 2023).

One of the key determinants in understanding the impact of educational applications on learning is how these applications are pedagogically designed. Becker (2000) emphasizes that a pedagogical design centered on learning objectives is necessary for computers and digital tools to increase student participation. Indeed, the study by Barrera-Osorio and Linden (2009) showed that access to digital tools alone does not increase success; Experimental findings have shown that effective integration is the main determinant. These findings are also reflected in the Turkish context. Özkale and Koç (2014) report that it becomes difficult to achieve the expected effects when tablets and applications are not consciously integrated into the teaching process.

Studies on the effects of mobile applications, especially on middle school students, show that applications positively affect students' learning motivation, attitudes towards the lesson, and academic performance. In a secondary school level evaluation study conducted by Karabatzaki et al. (2018), it was revealed that

mobile applications increased students' desire to learn and their participation. Similarly, in the study conducted by Güler, Üstün, and Yılmaz (2022), it was found that the self-efficacy of middle school students in using mobile applications was related to their success and motivation in mathematics lessons.

The effect of educational applications is observed not only in general subjects but also in specific disciplines. Research on computer game-based learning shows that gamified applications increase students' attention and desire to learn. The study conducted by Baylak et al. (2024) showed that the course-based computer game called "CoğrafyaIQ" increased students' geography achievement. In a study by Papadakis (2020) examining game development-based learning environments, it is noted that cognitive strategy use and problem-solving skills are particularly improved. Studies on educational applications in programming instruction have similar results. Montes-León et al. (2019), Seralidou and Douligeris (2019), and Salahli et al. (2017) found that application-based programming learning increased students' conceptual understanding.

Educational software, as well as mobile applications, plays an important role in the learning process. A study by Stanciu, Bocos, and Andronache (2012) reported that the use of educational software by secondary school students is positively correlated with academic performance. Studies on applications at the primary and secondary school levels show that educational software is particularly important for conceptual understanding and effective learning (Vannucci & Colla, 2010; Tay et al., 2014). There is strong evidence that educational applications make significant contributions to the learning processes of secondary school students. However, the literature shows that how, for what purpose, and within what pedagogical framework technology is used, rather than technology itself, is the fundamental determinant of effective learning. When educational practices are integrated with appropriate pedagogical approaches, they enrich the learning experience, improve academic performance, and enhance students' digital competencies. At this point, it is an undeniable fact that it also affects students' self-confidence in the learning process.

Self-confidence is considered one of the key factors determining students' academic success (Byiringiro, 2024). Individuals who feel comfortable and secure during the learning process increase their motivation levels, and self-confidence is known to play a decisive role, particularly in areas such as mathematics achievement (Ünver & Kılıç, 2025). In this context, the potential impact of technological advancements and digital tool use on students' perceptions of mathematical self-confidence has become an important area of investigation for current educational research.

Self-confidence in mathematics is an individual characteristic and critical factor that directly affects students' performance. Indeed, PISA (Programme for International Student Assessment) surveys include various questions aimed at measuring students' mathematical self-confidence. The PISA 2022 application, conducted by the OECD (Organization for Economic Co-Operation and Development), assesses elements, such as mathematical literacy, technology, and student preferences. Turkey's participation in this program provides a significant opportunity to assess its international standing and improve educational policies. Students in Turkey have disparities in access to technology (Ökten, 2024). These inequalities in access can directly impact students' academic self-confidence and success. The literature emphasizes that this situation creates a disadvantage in learning opportunities, especially for students with low socioeconomic status (Dolu, 2020; Reardon, 2018).

Within this framework, understanding the relationship between self-confidence in mathematics and technology use is considered crucial for developing strategies for integrating digital resources based on students' learning preferences and offering policy recommendations for equal opportunities in education. The purpose of this study is to examine the relationship between students' self-confidence in mathematics tasks and their access to technology, based on Turkey's PISA 2022 results. Considering the primary platforms through which students interact with technology in the 21st century and the potential impact of these platforms on learning processes, this research will address the identified sub-problems. The first sub-problem aims to examine whether owning a computer provides significant confidence in performing mathematical tasks for students participating in the PISA 2022 survey from Turkey. The second sub-problem will assess whether owning educational software and applications provides significant confidence in performing mathematical tasks for students participating in the PISA 2022 survey from Turkey. The

third sub-problem will investigate whether owning an internet-enabled mobile phone provides significant confidence in performing mathematical tasks for students participating in the PISA 2022 survey from Turkey. Finally, the fourth sub-problem aims to reveal whether having wireless internet at home provides significant confidence to students participating in the PISA 2022 survey from Turkey when performing mathematical tasks.

Limitations

This study is limited to research problems and PISA 2022 data.

The research sought to answer the following questions:

1. Does owning a computer provide meaningful confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks?
2. Does owning educational software and applications provide meaningful confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks?
3. Does owning a mobile phone with internet access provide meaningful confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks?
4. Does having wireless internet at home provide meaningful confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks?

3. Methodology

In this section, the research model, study group, data collection process, validity and reliability of data collection tools and analysis techniques are discussed.

3.1. Research Model/Design

The primary objective of this study is to determine the impact of using technology on the perception of confidence in performing mathematical tasks among students from Turkey who participated in the PISA 2022 survey. This research was conducted using the correlational screening model, a quantitative research method. Screening models are research designs that aim to describe participants' current status and characteristics by collecting data from large samples (Şahin, 2023). A correlational screening model, on the other hand, aims to reveal the degree and direction of the relationship between two or more variables (Bekman, 2022; Creswell, 2017). In this context, this study examined the relationships between students' access to technology (computer, wireless internet, mobile phone with internet access, and educational software/applications) and their level of feeling confident in mathematical tasks.

3.2. Data Collecting Tools

The research data were downloaded from the OECD's publicly available PISA 2022 database on March 17, 2025 (2022 Database – PISA (oecd.org)). The dataset consisted of responses to detailed student survey questions. For this study, 10 questions measuring students' confidence level in performing mathematical tasks and questions assessing students' access to technology were selected. The selected items had graded response categories that allowed students to quantify their subjective assessments. Questions about confidence in the mathematics tasks are Likert-type scales ranging from "not at all confident" to "very confident." Technology access was measured with "yes" or "no" response options.

3.3. Sampling or Study Group

The study population consisted of 15-year-old students from Turkey participating in the 2022 PISA program. According to the OECD technical report, the sample included in PISA in Turkey was selected using a stratified random sampling method to represent the 15-year-old population across the country. The sample for this study consisted of students who answered both questions measuring their perception of confidence in mathematics tasks and questions regarding technology access in the PISA 2022 survey. While

the number of students varied according to different sub-problems in the analyses, the sample size ranged from 3,400 to 3,500 students.

3.4. Data Analysis

Data analyses were conducted using a statistical software package. Prior to the main analyses, the distributional characteristics of the dataset were examined. The results of normality tests indicated that the assumptions of normal distribution were not met for the study variables. Due to this violation of parametric assumptions, non-parametric statistical techniques were employed to examine differences between groups. To compare two independent groups across the mathematical tasks included in the study, the Mann–Whitney U test was used, with the level of statistical significance set at $p < .05$. The Mann–Whitney U test is appropriate for ordinal-scale data and for situations in which distributional assumptions are not satisfied, allowing for the comparison of group medians in a robust manner (Ross & Willson, 2017). In addition to determining statistical significance, effect size (r) values were calculated to evaluate the practical relevance of the group differences. The interpretation of the effect size followed conventional guidelines, where higher r values indicate stronger associations between group membership and perceived confidence levels. This analytical approach was applied consistently across all tables in the study, enabling the comparison of confidence levels related to a wide range of mathematical tasks based on students' access to various technological resources.

3.5. Validity and Reliability

The PISA dataset consists of standardized measurement instruments tested for validity and reliability at the international level. The data collection process implemented by the OECD was supported by language adaptation, pilot testing, and statistical analysis. Therefore, the dataset offers a high level of reliability and reproducibility. In this study, the variable selection process was conducted in accordance with the purpose of the study and in accordance with the opinions of field experts; only the variables necessary for the analysis were extracted from the dataset and used. The data were coded and cleaned appropriately for statistical analysis.

3.6. Research Procedures

Analyses conducted to answer the research questions revealed the relationship between students' access to technological resources at home and their confidence level in mathematical tasks. The findings are detailed in tables for each subproblem.

3.7. Findings and Discussions

3.7.1. The Impact of Having a Computer at Home

Mann-Whitney U test was used to examine differences between students' possession of a computer (laptop, desktop, or tablet) at home and their confidence level in mathematical tasks. The analysis results are summarized in Table 1.

Table 1.

Differences in Perception of Confidence in Mathematics Tasks According to Having a Computer at Home (Mann-Whitney U Test)

Math Task	Group	N	Average Rank	Rank Total	Mann-Whitney U
Extracting information from graphs, diagrams, and simulations	Yes	2515	1778.26	4472335.00	1065695.00
	No	944	1601.41	1511735.00	
Identifying mathematical aspects of real-life problems	Yes	2577	1803.21	4646866.00	1192616.00
	No	977	1709.69	1670369.00	
Decision-making using the concept of statistical variation	Yes	2518	1778.23	4477594.50	1101034.50
	No	956	1630.21	1558480.50	
Interpreting mathematical solutions in a real-life context	Yes	2569	1796.32	4614745.00	1204040.00
	No	980	1719.11	1684730.00	
Identifying constraints and assumptions of mathematical modeling	Yes	2477	1770.55	4386051.00	1066236.00
	No	962	1589.85	1529190.00	
Representing a mathematical situation with variables	Yes	2512	1778.59	4467789.50	1084961.50
	No	954	1614.78	1539634.50	
Assessing the significance of patterns observed in data	Yes	2552	1780.70	4544115.00	1146854.00
	No	977	1709.69	1670369.00	
Computer programming/coding	Yes	2486	1772.73	4409697.00	1062348.50
	No	984	1641.44	1615623.00	
Using calculators/programs	Yes	2527	1811.46	4574846.50	1189052.50
	No	1018	1677.53	1707804.50	
Calculating the properties of an irregularly shaped object	Yes	2523	1766.61	4456804.50	1153983.00
	No	962	1681.07	1617144.50	

Mann–Whitney U test and effect size analyses examining the influence of having a computer at home on students' perceived confidence in mathematical tasks are presented in Table 1. The results indicated that students with home computer access ("Yes" group) consistently displayed higher mean ranks across all mathematics tasks compared to those without access ("No" group). This pattern suggests that computer availability positively influenced students' confidence in their mathematical abilities. The difference was particularly notable for the tasks "Identifying constraints and assumptions of mathematical modeling," "Extracting information from graphs, diagrams, and simulations," and "Representing a mathematical situation with variables."

3.7.2. The Impact of Having Educational Software and Applications

Mann-Whitney U test was used to examine differences between students' home ownership of educational software or applications and their perceived confidence in mathematical tasks. The analysis results are presented in Table 2.

Table 2.

Differences in Perception of Confidence in Mathematics Tasks According to the Possession of Educational Software and Application (Mann-Whitney U Test)

Math Task	Group	N	Average Rank	Rank Total	Mann-Whitney U
Extracting information from graphs, diagrams, and simulations	Yes	1716	1737.78	2982534.50	1384328.50
	No	1686	1664.57	2806857.50	
Identifying mathematical aspects of real-life problems	Yes	1760	1794.07	3154612.00	1442199.00
	No	1733	1699.20	2944385.00	
Decision making using the concept of statistical variation	Yes	1729	1740.61	3010756.50	1406344.50
	No	1689	1677.65	2832234.50	
Interpreting mathematical solutions in real-life context	Yes	1749	1784.05	3120448.50	1463827.00
	No	1746	1711.89	2995783.50	
Identifying constraints and assumptions of mathematical modeling	Yes	1722	1774.67	3055798.50	1306701.00
	No	1672	1618.02	2705799.50	
Representing a mathematical situation with variables	Yes	1734	1774.29	3078574.50	1337274.50
	No	1678	1636.45	2746140.50	
Assessing the significance of patterns observed in data	Yes	1703	1734.24	2955103.50	1351767.50
	No	1676	1645.04	2758540.50	
Computer programming/coding	Yes	1758	1770.33	3111701.50	1338130.00
	No	1652	1636.51	2704910.50	
Using calculators/programs	Yes	1742	1813.61	3162253.50	1410834.00
	No	1752	1681.77	2946878.50	
Calculating the properties of an irregularly shaped object	Yes	1749	1772.71	3101643.00	1368230.50
	No	1680	1654.92	2779530.00	

The effect of having access to educational software and applications on students' perceived confidence in mathematical tasks was examined using the Mann–Whitney U test and effect size analyses. The data in Table 2 indicate that students with access to such software and applications (“Yes” group) exhibited higher mean ranks on nearly all tasks compared to those without access (“No” group). This finding suggests that the use of educational technology contributes positively to students' confidence in their mathematical skills. The difference was particularly notable for tasks such as “Identifying constraints and assumptions of mathematical modeling,” “Representing a mathematical situation with variables,” “Computer programming/coding,” and “Using calculators/programs,” indicating that technology integration and the use of digital tools may have a stronger impact on students' confidence when dealing with complex or abstract mathematical concepts. Differences in the remaining tasks were smaller.

3.7.3. The Impact of Having a Mobile Phone with Internet Access

The Mann-Whitney U test was used to examine the effect of students' internet-enabled mobile phone ownership on their perception of confidence in mathematics tasks. The results of the analysis are presented in Table 3.

Table 3.

Differences in Perception of Confidence in Mathematics Tasks According to Owning a Mobile Phone with Internet Access (Mann-Whitney U Test)

Math Task	Group	N	Average Rank	Rank Total	Mann Whitney U
Extracting information from graphs, diagrams, and simulations	Yes	3039	1750.28	5319252.00	634289.00
	No	439	1664.85	730958.00	
Identifying mathematical aspects of real-life problems	Yes	3113	1793.04	5583732.50	675389.50
	No	453	1717.93	778740.50	
Decision making using the concept of statistical variation	Yes	3033	1750.56	5309566.50	668582.00
	No	454	1700.15	771870.50	
Interpreting mathematical solutions in real-life context	Yes	3148	1786.77	5620019.50	657067.50
	No	421	1771.73	745862.50	
Identifying constraints and assumptions of mathematical modeling	Yes	3035	1727.03	5242504.50	634233.00
	No	418	1726.80	722049.50	
Representing a mathematical situation with variables	Yes	3067	1751.74	5373741.00	608059.00
	No	416	1670.18	694159.00	
Assessing the significance of patterns observed in data	Yes	3027	1738.37	5262713.00	583089.50
	No	417	1607.30	670140.00	
Computer programming/coding	Yes	3060	1745.65	5342752.50	636023.00
	No	423	1715.60	725502.50	
Using calculators/programs	Yes	3099	1787.53	5539634.50	689439.00
	No	460	1729.28	795479.50	
Calculating the properties of an irregularly shaped object	Yes	3098	1746.47	5411465.50	610205.50
	No	401	1777.29	712710.50	

The analyses in Table 3 examining the potential effect of having an internet-enabled mobile phone on students' perceived confidence in mathematical tasks revealed a generally positive, though small, relationship. According to the Mann–Whitney U test results, students with mobile phones showed higher mean ranks than those without phones on most tasks. Although the overall differences were modest, the findings suggest that mobile phone access may offer a slight advantage in students' confidence regarding mathematical skills. Notably, students without mobile phones showed higher perceived confidence than their peers with phones on the task “Calculating the properties of an irregularly shaped object,” indicating that this specific skill may not benefit from mobile phone access in the same way as others.

3.7.4. The Impact of Having Wireless Internet at Home

The differences between students' access to wireless internet at home and their level of feeling safe in math tasks were compared using the Mann- Whitney U test. The analysis results are presented in Table 4.

Table 4.

Differences in Perception of Confidence in Mathematics Tasks According to Having Wireless Internet at Home (Mann-Whitney U Test)

Math Task	Group	N	Average Rank	Rank Total	Mann Whitney U
Extracting information from graphs, diagrams, and simulations	Yes	2998	1752.84	5254124.00	652553.00
	No	471	1621.46	763709.00	
Identifying mathematical aspects of real-life problems	Yes	3047	1789.08	5449679.50	752376.50
	No	512	1725.99	883704.50	
Decision making using the concept of statistical variation	Yes	2979	1752.93	5221691.00	709198.00
	No	501	1666.56	834949.00	
Interpreting mathematical solutions in a real-life context	Yes	3048	1782.77	5433401.50	782524.00
	No	515	1777.46	915394.50	
Identifying constraints and assumptions of mathematical modeling	Yes	2955	1725.59	5096056.50	731108.00
	No	495	1724.99	853868.50	
Representing a mathematical situation with variables	Yes	2978	1749.48	5209720.50	705852.00
	No	497	1669.23	829605.50	
Assessing the significance of patterns observed in data	Yes	2936	1740.02	5110652.50	670809.50
	No	500	1592.12	796059.50	
Computer programming/coding	Yes	2993	1732.07	5182785.00	703554.00
	No	482	1774.84	856128.00	
Using calculators/programs	Yes	3029	1794.99	5436897.50	730029.50
	No	521	1662.21	866010.50	
Calculating the properties of an irregularly shaped object	Yes	3006	1754.67	5274324.50	702882.50
	No	485	1692.24	821396.50	

As shown in Table 4, there was a generally positive relationship between having wireless internet at home and students' perceived confidence in mathematical tasks. In most tasks, students with wireless internet access demonstrated higher mean ranks than those without access, indicating that home internet connectivity may contribute to stronger confidence in mathematical skills. Although the overall differences were modest, the findings suggest that internet access offers a slight advantage in several areas. Notably, the task "Computer programming/coding" showed higher mean ranks for students without wireless internet access, suggesting that this particular skill may not be as strongly influenced by home internet availability as the others.

3.7.5. Discussion

This study examined the relationship between students' access to technology and their perceived confidence in mathematical tasks using PISA 2022 data. The findings showed that digital access (computers,

educational software, and the internet) generally positively influenced students' perceptions of confidence in mathematical tasks. Specifically, access to computers and educational software had a moderate effect on increasing students' confidence in abstract and complex tasks such as modeling, simulation, graphical interpretation, and representation with variables, supporting the pedagogical integration potential of these tools. This finding is consistent with the literature highlighting the power of educational software and digital tools to concretize abstract concepts (Stanciu et al., 2012; Vannucci & Colla, 2010; Karabatzaki et al., 2018). Furthermore, access to technology significantly influenced students' perceptions of confidence in practical skills such as computer programming/coding and calculator use. This finding is supported by previous research showing that mobile and computer-based applications offer students functional learning environments (Montes-León et al., 2019; Seralidou & Douligeris, 2019; Papadakis, 2020).

The effect of students' access to internet-connected mobile devices and home Wi-Fi on their perceptions of confidence in mathematical tasks was more limited compared to other types of technology access. Analyses revealed that effect sizes were generally low. While a positive contribution was found in most tasks, it is noteworthy that some specific tasks yielded contradictory findings. These results indicate that access to technology alone is not sufficient to increase students' perceptions of confidence; rather, the purpose of use, pedagogical integration, and the learning strategies adopted by students are determining factors. This finding is consistent with the results of some studies in the literature that highlight concerns about the distracting potential and limited contributions of mobile devices (Rosen et al., 2013; Boyalı, 2020). Furthermore, it has been reported in relevant studies that the effective use of mobile devices in education is closely related to the quality of applications, instructional design, and student self-efficacy (Guler et al., 2022; Ababa et al., 2021; De La Cruz et al., 2023).

The findings are significantly consistent with existing studies in the literature. According to a study by Yorgancı (2019), teaching abstract algebra using a computer-assisted ISETL program increased the academic achievement of prospective teachers and positively improved their attitudes towards mathematics. The study shows that the use of computers can make abstract concepts more concrete. Similarly, a study by Egara et al. (2022) states that computer simulations significantly increased middle school students' interest in algebra. The simulation-based teaching approach helped students develop a more positive perspective towards mathematics by supporting their active participation in the lesson. These findings, which reveal the contribution of educational software and simulation-based applications to learning motivation, are consistent with other international studies (Tay et al., 2014; Karabatzaki et al., 2018).

On the other hand, Chen et al.'s (2025) meta-analysis shows that mobile phone use disrupts attention during learning in young adults and negatively affects short-term recall. The findings revealed that mobile phone-related distractions lead to significant decreases, especially in "instant recall" performance. Similarly, the literature contains findings that uncontrolled use of mobile devices can have negative effects on learning outcomes, reduce student focus, and increase cognitive load (Durak & Yılmaz, 2019). Therefore, the current findings should be evaluated holistically with both supportive and critical conclusions. This holistic framework emphasizes the importance of distinguishing technology tools in terms of their functionality and usage contexts. While computers and educational software serve as a bridge for understanding abstract mathematical concepts, mobile devices can become distracting when used uncontrollably. From an education policy perspective, access to technology can both increase learning opportunities and reduce inequalities, but it can also create new areas of inequality for disadvantaged groups due to cost and access issues. In this context, simply providing equipment to schools is not enough; quality educational software, teacher support, and pedagogical integration also play a critical role. Especially in abstract subjects like mathematics, technology-supported applications can contribute to conceptual understanding and save time. This view suggests that mobile and computer-based tools in educational applications can be used to improve learning.

4. Conclusion and Suggestions

This research aimed to address the following questions: 1. Does owning a computer provide significant confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks? 2. Does owning educational software and applications provide significant confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks? 3. Does owning a mobile phone with internet access provide significant confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks? 4. Does having wireless internet at home provide significant confidence to students participating in the PISA 2022 survey from Turkey when doing math tasks? The Mann-Whitney U test was used to analyze the PISA 2022 SPSS data set. The analysis revealed that access to a computer and educational software for homework led to a statistically significant advantage for students in all ten math-related questions. However, having a mobile phone with internet access and wireless internet at home showed a significant difference in some of the 10 questions related to performing mathematics tasks in favor of students with a mobile phone with internet access and wireless internet at home.

Based on these findings, it can be recommended that education stakeholders be made aware of the use of technology and the use of technology by students. Educational technologies should be made available to all students. Applications that support mathematics teaching should be developed. Public service announcements can be created to help individuals use educational technologies consciously. Projects can be developed and disseminated to use educational technologies consciously.

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