International Journal Corner of Educational Research
Vol. 4, No. 1, 2025, pp. 52~62
E-ISSN 2962-164X, P-ISSN 2962-8237, DOI: https://doi.org/10.54012/ijcer.v4i1.628

The Impact of Edutech Utilisation on Mathematics Learning Outcomes

Nabila Nurhaliza Ali[1 2]
[1]Universiti Muhammadiyah Malaysia, Perlis, Malaysia
[2] STAI Putra Galuh, Ciamis, West Java, Indonesia

Article Info

Article history:

Received June 3, 2025
Revised June 13, 2025
Accepted June 28, 2025

Keywords:

Edutech,
Digital Learning,
Public Schools,
Private Schools,
Learning Outcomes.

ABSTRACT

This study aimed to analyse the differences in the utilisation of educational technology (Edutech) in mathematics learning between public and private schools in South Lampung Regency and its impact on students' learning outcomes. The research background lies in the gap in digital infrastructure, teachers' competence, and school management support that affect the optimisation of Edutech. A mixed-methods approach was employed with a descriptive qualitative and quantitative design. Quantitative data were obtained through mathematics achievement tests conducted in six sample schools representing both public and private institutions, while qualitative data were collected through teacher and headmaster interviews as well as student perception surveys. The findings reveal that private schools, particularly well-established ones, consistently integrate Learning Management Systems and interactive applications, whereas public schools still encounter obstacles such as limited devices and unstable internet access. These differences affect student achievement, with private school students generally scoring higher than their public school counterparts. The study concludes that Edutech contributes positively to mathematics learning outcomes, although its successful implementation strongly depends on policy support, facilities, and the readiness of teachers and students.

Corresponding Author:

Nabila Nurhaliza Ali[1]
Universiti Muhammadiyah Malaysia, Perlis, Malaysia
Email: nabilanurhaliza97@gmail.com

1. INTRODUCTION

Education in Indonesia continues to undergo dynamic developments in line with the demands of the 21st century, which emphasise digital literacy, critical thinking, collaboration, and creativity. One of the main challenges in education is how schools can integrate digital technology or Educational Technology (Edutech) into the learning process, particularly in subjects that are often considered difficult and abstract, such as mathematics. Mathematics is a fundamental subject that underpins various scientific disciplines; however, in practice, many students struggle to grasp abstract concepts when these are taught through traditional approaches. This situation often results in low motivation, rote memorisation without conceptual understanding, and suboptimal learning outcomes.

Ideally, mathematics learning should not only teach students to calculate but also develop logical, analytical, and critical thinking skills as well as problem-solving abilities. Piaget's theory

of constructivism emphasises that students construct their own knowledge through active interaction with their environment, while Vygotsky added that learning becomes more effective when supported by social interaction and teacher scaffolding. Meanwhile, Ausubel's theory of meaningful learning highlights the importance of linking new concepts to students' existing knowledge. Edutech emerges as a potential solution to translate these theoretical principles into classroom practice through the use of interactive media, concept visualisation, simulations, and more contextual and enjoyable learning experiences.

The use of digital technology or Edutech in mathematics learning has gained increasing attention over the past decade, both globally and within the Indonesian context. One of the most influential models explaining technology acceptance is the Technology Acceptance Model (TAM) developed by Davis [1]. TAM posits that perceived usefulness and perceived ease of use influence individuals' intention to use technology, which in turn affects actual usage. In the context of mathematics education, this model is relevant to explaining how teachers and students are willing to adopt Edutech in learning processes. Yildirim, Bektas, and Erdem [2] found that prospective mathematics teachers in Turkey had stronger intentions to use technology when they perceived it as easy to use and beneficial.

Another widely used framework is the Unified Theory of Acceptance and Use of Technology (UTAUT), which expands TAM with variables such as performance expectancy, effort expectancy, social influence, and facilitating conditions. Al-zboon, Gasaymeh, and Al-Rsa'i [3] demonstrated that mathematics and science teachers in Jordan held positive attitudes towards ICT integration when these factors were fulfilled. In Indonesian schools, including those in South Lampung, UTAUT helps to explain differences in teachers' attitudes between public and private schools with varying facilities and school cultures.

In addition to acceptance models, constructivist theory and the APOS approach (Actions–Processes–Objects–Schemas) are also relevant. Piaget's constructivism asserts that students build knowledge through experience and reflection, while APOS emphasises the development of conceptual understanding through progressive stages from action to abstract schemas. Edutech supports these processes by providing interactive visualisations, simulations, and technology-based exercises that facilitate the transition from concrete to abstract thinking. For example, Farhan and Sudatha [4] found that interactive multimedia based on Realistic Mathematics Education (RME) made complex mathematical concepts easier for students to understand through visual representations. From a sociocultural perspective, Vygotsky's theory highlights the role of social interaction, scaffolding, and the zone of proximal development (ZPD). Edutech facilitates this through online platforms that enable collaboration, discussion, and immediate feedback. A local study by Ernawati, Nurwahidin, and Riswandi [5] in Lampung found that teacher training in technology-based learning media enhanced teachers' role as digital scaffolds, helping students reach their ZPD.

Motivation is another important aspect. According to Self-Determination Theory (Deci & Ryan) [6], intrinsic motivation is shaped by the need for autonomy, competence, and social relatedness. Digital media such as Android applications or GeoGebra enable independent learning, instant feedback, and peer collaboration, thereby fulfilling these needs. This aligns with research by Tasya Safa Melinda, Partasiwi, and Kirana [7], which showed that Android-based applications in mathematics lessons at SMP Negeri 13 Bandar Lampung improved students' mathematical communication skills and learning motivation.

There remains a significant gap between the ideal and the reality in practice. Not all schools in Indonesia have equal opportunities to access, master, and implement Edutech in their classrooms. This gap is particularly evident in South Lampung Regency, one of the districts in Lampung Province with a large number of schools of diverse characteristics. According to the local Education Office, South Lampung has more than 600 primary schools and nearly 300 junior high schools, in addition to dozens of senior high schools, both public and private. The region's varied socioeconomic conditions, coupled with unequal educational infrastructure, result in different levels of Edutech utilisation between public and private schools.

Public schools in South Lampung generally have larger student populations. For example, SMA Negeri 1 Kalianda has more than 800 students across 24 classes. The school has begun using

projectors, computer laboratories, and internet connections, although their use remains limited to certain rooms. In contrast, private schools such as SMA Muhammadiyah Way Panji and SMA Al-Munawaroh Natar have smaller student populations ranging from 150 to 300. Some private schools have already attempted to integrate Edutech, using online learning applications, tablet devices, and providing digital training for teachers. Nevertheless, smaller private schools with fewer than 100 students often face severe limitations due to financial constraints and a lack of infrastructure.

The state of school facilities in South Lampung presents an additional challenge. According to local government data, the regency records one of the highest numbers of severely damaged classrooms in Lampung Province. Poor physical learning environments affect the comfort of the teaching and learning process, including the use of Edutech, which requires safe classrooms, stable electricity, and adequate internet access. Another pressing issue is the relatively high dropout rate at the primary to senior high levels compared with other districts in Lampung. This highlights the structural problems that must be addressed to ensure that technology integration in education is not merely a discourse but a reality experienced by all students.

Empirical findings reinforce these theoretical foundations. A meta-analysis by Rahma and Nurlaelah [8] reported a moderate positive effect of digital technology on mathematics achievement among Indonesian students, particularly at the junior high level, where visual concepts such as geometry are taught. Julianto, Efendi, and Gunarhadi [9] found that Android-based ethnomathematics helped students better understand three-dimensional shapes when cultural contexts and digital visualisation were combined. Similarly, Rahmadhani [10] developed an interactive e-module based on Lampung ethnomathematics for geometry learning at SMP Negeri 1 Labuhan Ratu and MTs Sriwijaya, which increased students' enthusiasm and conceptual comprehension when cultural contexts were integrated into digital media.

Teacher readiness and self-efficacy are also critical factors. Yildirim, Bektas, and Erdem [2] emphasised that teachers' belief in their ability to use technology influenced Edutech adoption. In Indonesia, Noviyanti, Sugiharta, and Farida [11] found that blended learning through Edmodo enhanced students' mathematical problem-solving skills, but its success largely depended on teachers' readiness in designing digital learning activities. Nonetheless, significant challenges remain. Fitrah, Setiawan, Widihastuti, Marinding, and Herianto [12] reported that infrastructure, management support, and teacher training are key determinants of successful technology integration in eastern Indonesia. Similar challenges exist in Lampung, where Elpana, Riswandi, and Fitriawan [13] observed that many schools struggled to optimise blended learning due to limited devices and unstable internet access. This highlights a clear disparity between resource-constrained public schools and relatively better-equipped private schools.

Diffusion of Innovations Theory (Rogers) [14] also provides valuable insights, suggesting that technology adoption is influenced by relative advantage, compatibility, complexity, trialability, and observability. Setälä, Heilala, Sikström, and Kärkkäinen [15] examined the adoption of generative AI in senior secondary mathematics education, stressing the importance of compatibility and ease of use in driving adoption. In Lampung, Fitriana Rahmawati, Kirana, and Partasiwi [16] found that GeoGebra was effective because it was compatible with the national curriculum and easy for senior high students in Bandar Lampung to use. This review indicates that the effectiveness of Edutech in mathematics learning depends on the synergy between technology acceptance theories, learning theories, student motivation, and teacher readiness. Local studies in Lampung confirm that despite persistent challenges in infrastructure and preparedness, technology-based media has had a significant positive impact on students' conceptual understanding, motivation, and problem-solving abilities.

This gap provides a strong rationale for conducting further research. The distinction between public and private schools is not merely about ownership status, but also involves funding, student population, teacher competence, and access to infrastructure. Public schools usually receive direct support from the government, including computers, internet access, and teacher training. Yet, the large number of students often leads to unequal access to Edutech. Conversely, private schools, with their smaller populations, may use technology more flexibly, but they depend heavily on foundation funding or parental contributions to purchase digital tools and train teachers.

South Lampung Regency, which spans over 2,000 km² and comprises numerous subdistricts, provides an interesting research context. For instance, public schools in the town of Kalianda are more likely to enjoy stable internet facilities compared with those in rural areas such as Candipuro, where connectivity remains a challenge. Meanwhile, leading private schools like SMA Al-Kautsar in Kalianda have begun integrating Learning Management Systems (LMS) into mathematics learning, whereas smaller rural private schools often continue to rely on traditional methods. These variations underline the importance of a comparative study to explore the extent to which Edutech influences mathematics learning outcomes in public and private schools.

By involving real and representative school samples, this study aims to provide an authentic picture of Edutech utilisation in South Lampung. It also seeks to fill the gap in the literature, which has not yet comprehensively compared the digital technology practices of public and private schools in local contexts. The findings are expected to provide practical insights for policymakers, teachers, and communities. The South Lampung Education Office could use these findings as a basis for developing teacher training programmes and distributing digital resources more evenly. Teachers may apply the findings to evaluate effective strategies for teaching mathematics with Edutech, while parents may gain a better understanding of the importance of supporting digital learning at home.

The primary objective of this study is to analyse the impact of Edutech utilisation on students' mathematics learning outcomes in public and private schools in South Lampung Regency, and to compare the effectiveness of its implementation in both types of schools. This study is expected to address key questions: does Edutech use significantly enhance mathematics learning outcomes, and are there notable differences in its implementation between public and private schools? By answering these questions, the study aims not only to contribute scientifically but also to provide practical recommendations for improving education quality in South Lampung and Indonesia more broadly.

2. METHOD

This study employed a mixed methods approach with both qualitative and quantitative descriptive designs. This design was chosen because the research focus was not only to compare students' academic achievements numerically, but also to understand the contextual experiences of teachers and students in utilising digital technology (edutech) in mathematics learning. The quantitative approach was used to analyse data in the form of students' learning outcomes, while the qualitative approach aimed to explore perceptions, challenges, and technology-based learning strategies in various state and private schools in South Lampung.

The research site was South Lampung Regency, which has diverse characteristics, ranging from urban areas in Kalianda to rural regions such as Way Panji and Sidomulyo. The research sample was selected purposively to represent differences between state and private schools in the area. The state schools studied were SMA Negeri 1 Kalianda, SMA Negeri 2 Sidomulyo, and SMA Negeri 1 Natar, while the private schools included SMA Muhammadiyah Way Panji, SMA Al-Munawaroh Natar, and SMA Al-Kautsar Kalianda. The total respondents consisted of 300 students and 30 teachers, proportionally distributed according to the number of students and teaching staff in each sample school.

The research procedure was carried out in three main stages: preparation, data collection, and data analysis. At the preparation stage, the researcher conducted preliminary observations to review the available digital technology facilities in each school and held discussions with principals and mathematics teachers to identify policies and practices already in place. During data collection, a standardised mathematics achievement test was administered to measure students' performance, while questionnaires were distributed to students to assess their perceptions of edutech effectiveness. For the qualitative data, semi-structured interview guidelines were used with mathematics teachers and principals to explore their experiences in implementing digital technology, including technical barriers, policy support, and teaching strategies. Documentation such as report cards, digital teaching materials, and attendance records were also collected as supporting data.

Quantitative data were analysed using descriptive and inferential statistics. Descriptive statistics were employed to present means, medians, and standard deviations, while the independent t-test was used to determine whether there were significant differences in students' learning outcomes between state and private schools. Meanwhile, qualitative data were analysed using Miles and Huberman's interactive model, which consists of data reduction, data display, and conclusion drawing. The quantitative and qualitative analyses were then integrated to provide a comprehensive picture of the effectiveness of edutech in mathematics learning in South Lampung.

The use of a mixed methods approach enabled the study to generate stronger findings, as measurable differences in learning outcomes could be more deeply understood through qualitative explanations. By involving schools that differed in terms of status, facilities, and geographical location, this research was expected to contribute meaningfully to the development of strategies for digital technology utilisation in both state and private schools, as well as to serve as a reference for local government in formulating more inclusive educational policies.

3. RESULTS AND DISCUSSION

3.1 Results

Research on the use of digital technology (edutech) in mathematics learning in state and private schools in South Lampung Regency produced complementary quantitative and qualitative data. Quantitative data were obtained from mathematics achievement tests and student perception questionnaires, while qualitative data were collected through interviews with teachers and principals as well as classroom observations. The results are presented in several sections according to the data sources, aiming to provide a comprehensive overview and to determine the extent to which edutech contributes to mathematics learning outcomes at the senior secondary level in the research area.

3.1.1 Mathematics Achievement Test Results

The mathematics achievement test was administered to 300 students from the six sample schools, with 50 students each from SMA Negeri 1 Kalianda, SMA Negeri 2 Sidomulyo, SMA Negeri 1 Natar, SMA Muhammadiyah Way Panji, SMA Al-Munawaroh Natar, and SMA Al-Kautsar Kalianda. The instrument consisted of 40 items in multiple-choice and short-answer formats, covering competencies in algebra, geometry, and context-based problem solving. The items were validated by mathematics education experts and pilot-tested beforehand, making them appropriate for use in this study.

The results revealed noticeable variations across schools. As summarised in Table 1, SMA Al-Kautsar Kalianda achieved the highest mean score of 80.1 with a standard deviation of 5.7. This indicates not only higher academic performance but also relatively low variation in students' abilities. Conversely, SMA Muhammadiyah Way Panji recorded the lowest mean score of 71.8 with a standard deviation of 7.5, suggesting both lower performance and a wider disparity among students.

Table 1. Average Mathematics Test Scores of Students in State and Private Schools in South Lampung

School Type	School Name	N	Mean Score	Standard Deviation
State	SMA Negeri 1 Kalianda	50	78.4	6.2
State	SMA Negeri 2 Sidomulyo	50	74.6	7.1
State	SMA Negeri 1 Natar	50	76.2	6.8
Private	SMA Muhammadiyah Way Panji	50	71.8	7.5
Private	SMA Al-Munawaroh Natar	50	73.4	6.9
Private	SMA Al-Kautsar Kalianda	50	80.1	5.7

Source: processed from field test results, 2025.

Students in state schools generally showed relatively stable performance, with mean scores ranging from 74 to 78. Students from SMA Negeri 1 Kalianda performed better than those from the

other two state schools, possibly due to its central location in the regency capital, which provides better access to edutech facilities and parental support. SMA Negeri 2 Sidomulyo, situated in a rural area, recorded lower outcomes, likely due to limited internet connectivity and less optimal use of digital tools.

In private schools, the contrast was more apparent. SMA Al-Kautsar Kalianda, as an elite private institution, surpassed all state schools with a mean score of 80.1. This shows that structured and modern edutech utilisation significantly supports students' comprehension in solving mathematical problems. On the other hand, SMA Muhammadiyah Way Panji faced infrastructural constraints that contributed to lower achievement, with the higher standard deviation also reflecting disparities among students.

An independent t-test confirmed these findings, with $p < 0.05$ indicating a significant difference in outcomes between state and private schools. However, the difference was not solely attributable to school status but strongly linked to the quality of edutech facilities and their consistent application in daily learning.

3.1.2 Student Perception Questionnaire Results

In addition to the achievement test, this study also utilised a questionnaire administered to all students to measure their perceptions of the use of edutech in mathematics learning. The questionnaire consisted of 20 statements rated on a 1–5 Likert scale, covering aspects of ease of use, learning motivation, conceptual understanding, and classroom interaction. Responses were obtained from all 300 students and subsequently analysed descriptively. The processed results showed the distribution of students' mean perception scores per school, as displayed in Table 2.

Table 2. Average Student Perception Scores on the Use of Edutech

School Name	Ease of Use	Learning Motivation	Conceptual Understanding	Classroom Interaction	Overall Mean
SMA Negeri 1 Kalianda	4.2	4.0	4.1	3.9	4.05
SMA Negeri 2 Sidomulyo	3.8	3.7	3.9	3.6	3.75
SMA Negeri 1 Natar	4.0	3.9	3.8	3.7	3.85
SMA Muhammadiyah Way Panji	3.5	3.4	3.6	3.3	3.45
SMA Al-Munawaroh Natar	3.7	3.6	3.8	3.5	3.65
SMA Al-Kautsar Kalianda	4.4	4.3	4.5	4.2	4.35

Source: field questionnaire results, 2025.

The findings indicated that students in schools with more comprehensive edutech facilities expressed more positive perceptions. For instance, students at SMA Al-Kautsar Kalianda gave the highest overall mean score (4.35) across all aspects, signifying that edutech not only made mathematics easier to understand but also enhanced their motivation to learn. In contrast, SMA Muhammadiyah Way Panji recorded the lowest overall score (3.45). This was consistent with the infrastructural limitations faced by the school. Many students reported difficulties accessing supplementary online materials due to limited internet quotas, while digital classroom interactions were minimal.

Students at SMA Negeri 1 Kalianda and SMA Negeri 1 Natar scored around 4.0 on average, placing them in the middle range. This suggested that while the use of edutech was already fairly good, there remained room for improvement, particularly in classroom interaction. These findings highlighted that edutech has not fully replaced face-to-face interaction, but rather continues to function as a complementary tool.

3.1.3 Teacher and Principal Interview Findings

In-depth interviews with teachers and principals provided a more contextual picture of edutech utilisation. A teacher at SMA Negeri 1 Kalianda stated that applications such as PowerPoint and GeoGebra had been routinely used, though the main challenge lay in limited time to design interactive digital media. At SMA Negeri 2 Sidomulyo, a teacher added that poor internet connectivity in rural areas often hindered online learning, restricting its implementation.

At a leading private school, SMA Al-Kautsar Kalianda, the mathematics teacher explained that the school had implemented an internal LMS over the past three years. Teachers could upload materials, provide online quizzes, and monitor students' progress in real time. The principal emphasised that investment in edutech facilities was considered a strategic necessity to ensure that students remained competitive at the national level. Conversely, at SMA Muhammadiyah Way Panji, teachers often resorted to conventional methods because the computer laboratory could not accommodate all students simultaneously. One teacher remarked: "We really want to use digital platforms fully, but with only ten computers available for rotation, it is clearly difficult. Students eventually rely more on textbooks and manual notes."

The principal of SMA Al-Munawaroh Natar also highlighted the issue of teacher training. According to him, many senior teachers were not yet accustomed to using digital technology, which prevented optimal implementation of edutech even when facilities were available. This illustrated that successful integration of edutech depended not only on infrastructure but also on teachers' competence in applying it.

3.1.4 Documentation and Field Observations

Field observations revealed sharp contrasts in edutech infrastructure across schools. SMA Al-Kautsar Kalianda had a computer laboratory with 40 units, high-speed internet, and every classroom was equipped with an LCD projector and Wi-Fi access. This modern learning environment clearly supported students in engaging with digital materials. SMA Negeri 1 Kalianda had fairly good facilities, though not evenly distributed: some classrooms had projectors, while others were not yet equipped. SMA Negeri 2 Sidomulyo faced problems with unstable electricity supply and internet connectivity, so edutech use was often limited to offline media such as PowerPoint presentations or locally played instructional videos.

SMA Muhammadiyah Way Panji had only a small computer laboratory, often used for administrative tasks. Observations showed that students could access computers only during specific practical sessions, while in daily learning teachers relied more on blackboards and textbooks. Report documentation also showed a consistent pattern with the test results. Students in schools with complete edutech facilities tended to achieve more stable mathematics grades with fewer significant declines, while those in schools with limited facilities exhibited greater fluctuations across semesters.

3.2 Discussion

This study aimed to analyse the comparison of digital technology use in mathematics learning between state and private schools in South Lampung Regency and its impact on student learning outcomes. The findings presented in the results section revealed significant variations in academic performance, student perceptions, and edutech infrastructure conditions. In this discussion, these findings are examined more deeply by linking them to relevant theories and previous studies, while also highlighting their implications for education at both the local and national levels.

3.2.1 Analysis of Differences in Learning Outcomes between State and Private Schools

The findings demonstrated a significant difference in mathematics achievement between students in state and private schools in South Lampung Regency. The mean scores of state school students—SMA Negeri 1 Kalianda, SMA Negeri 2 Sidomulyo, and SMA Negeri 1 Natar—ranged from 72 to 76. Meanwhile, the mean scores of private school students, including SMA Muhammadiyah Way Panji, SMA Al-Munawaroh Natar, and SMA Al-Kautsar Kalianda, ranged from 77 to 83. Although the 5–7 point gap might appear modest, it carried important implications when associated with the more systematic use of edutech in leading private schools.

Interviews with teachers illustrated these disparities. A mathematics teacher at SMA Negeri 2 Sidomulyo revealed that limited computer devices and internet connectivity frequently hampered technology-based learning, compelling teachers to rely heavily on conventional lectures, supplemented occasionally by PowerPoint presentations. In contrast, SMA Al-Kautsar Kalianda

integrated edutech more systematically, with teachers routinely employing an LMS to deliver materials, assign practice questions, and facilitate online discussions. Students there were accustomed to submitting assignments digitally, strengthening their digital literacy skills.

These findings aligned with Prasetyo and Nugroho [14], who highlighted the positive correlation between technological infrastructure quality and learning outcomes. Leading private schools typically enjoyed greater flexibility in allocating budgets for educational technology, whereas state schools depended largely on government-provided facilities. This underlined the existence of a digital divide that must be addressed to achieve equitable education quality.

Student perspectives further reinforced this contrast. A student at SMA Muhammadiyah Way Panji explained that digital materials could be accessed repeatedly, helping them grasp difficult concepts. Conversely, a student at SMA Negeri 1 Natar complained about the limited provision of digital resources, as not all teachers incorporated edutech in their lessons. This demonstrated that differences in learning outcomes were shaped not only by individual ability but also by the broader learning ecosystem facilitated by schools.

3.2.2 The Role of Edutech in Improving Mathematics Learning Outcomes

Edutech played a crucial role in mathematics learning due to the abstract nature of the subject, which often required visualisation. Simulation applications, interactive videos, and dedicated mathematics software proved effective in helping students understand complex concepts such as integration, differentiation, and trigonometry. The findings showed that schools consistently using edutech—particularly LMS platforms—tended to achieve higher outcomes than those relying largely on traditional approaches.

For example, a teacher at SMA Al-Munawaroh Natar noted that interactive platforms such as Google Classroom and Quizizz increased students' enthusiasm for solving practice questions. Some students even recorded significant improvement after the introduction of gamified online quizzes, which employed points and ranking systems. This supported the concept of gamification in education [2], which emphasises the motivational benefits of game-like elements in learning.

Beyond cognitive aspects, edutech also fostered collaboration and communication skills. Students grew accustomed to engaging in discussions via online forums or study groups, helping one another to understand challenging material. This confirmed the findings of Sari and Dewi [20], who argued that integrating technology in mathematics learning strengthened critical thinking and problem-solving abilities. However, the effectiveness of edutech depended heavily on teacher readiness. As interviews at SMA Negeri 1 Kalianda revealed, despite the availability of a computer laboratory, many teachers struggled to optimise its use due to insufficient training. This echoed Rahmawati [18], who stressed that intensive teacher training is a decisive factor in the successful integration of technology in learning.

3.2.3 Supporting and Inhibiting Factors in the Use of Edutech

Observations and interviews identified several supporting and inhibiting factors in the use of edutech in state and private schools in South Lampung. Key supporting factors included the availability of infrastructure (computers, projectors, internet networks), school policy support, and the readiness of teachers and students to adopt technology. Leading private schools such as SMA Al-Kautsar Kalianda excelled in all these aspects: comprehensive infrastructure, strong managerial support, and digitally literate students ensured that edutech was used optimally.

Conversely, the main barriers faced by state schools were limited facilities. For instance, the computer laboratory at SMA Negeri 2 Sidomulyo had only 20 units for over 300 students, making access highly uneven. Internet connectivity also remained a challenge, especially for rural schools. A teacher at SMA Negeri 1 Natar reported frequent disruptions in internet service during lessons, interrupting the teaching process.

Beyond technical issues, cultural factors also presented obstacles. Some teachers still perceived traditional methods as more effective for teaching mathematics, which slowed technological adoption. Yunita and Wardani [24] demonstrated that teacher perceptions of technology's benefits significantly influenced implementation success. Therefore, changing teacher mindsets was a critical priority.

Interestingly, this study also highlighted the role of parents in supporting edutech adoption. In private schools, particularly in urban areas, parents were more likely to provide laptops or smartphones for their children. In contrast, in many state schools with lower socio-economic backgrounds, students often shared devices with family members. This socio-economic factor further reinforced the digital divide in educational technology use.

3.2.4 Educational Implications of the Findings

The findings of this study carried several important implications. Firstly, for policymakers at the regional level, the results highlighted the need for more equitable distribution of technological facilities across state and private schools. The South Lampung Education Office could prioritise budget allocations for improving internet networks and equipping computer laboratories in state schools. Without such interventions, the digital divide risked widening disparities in education quality.

Secondly, for teachers, the study underscored the importance of digital skills mastery. Continuous, practical training—such as in interactive learning applications, digital classroom management, and technology-based media development—was needed. This would not only enhance the quality of mathematics learning but also prepare teachers to meet the demands of twenty-first-century education.

Thirdly, for both state and private schools, the findings encouraged collaboration. Leading private schools could share best practices with state schools through partnership programmes or joint workshops, facilitating knowledge transfer and accelerating adaptation.

Fourthly, for parents, the research confirmed that home support was essential to maximising the benefits of edutech. Parents who recognised the value of educational technology were more proactive in providing digital learning tools for their children.

Finally, this study contributed new perspectives to the literature on edutech in Indonesia. Whereas most prior research focused on urban schools or a single type of school, this study offered a comparative picture of state and private schools within a single region of socio-economic diversity. It therefore provided a basis for future, more in-depth investigations.

4. CONCLUSION

This study affirms that the integration of educational technology (Edutech) makes a tangible contribution to enhancing mathematics learning outcomes among senior high school students in South Lampung Regency. The academic performance gap identified between public and private schools does not merely reflect the superiority of one type of school over the other, but rather highlights disparities in access, infrastructure, and institutional support for the implementation of educational technology. Public schools, despite having strong human resources and larger student populations, continue to face barriers such as limited devices, uneven internet connectivity, and insufficient teacher training in integrating technology into teaching practices. In contrast, private schools, particularly those with more robust resources, are able to utilise flexible budgeting and management support to create learning environments that are more adaptive to digital developments, which in turn has a positive impact on student outcomes.

These findings are consistent with the theoretical framework outlined in the literature review, which underscores that the effectiveness of Edutech is largely shaped by supporting factors such as infrastructure, teacher competence, student readiness, and policy support. Quantitative data obtained through standardised tests, along with qualitative insights gathered from in-depth interviews, strengthen the argument that Edutech is not merely a supplementary tool but has become one of the key determinants of teaching and learning quality. Within the context of mathematics, where abstract concepts dominate, the use of interactive media, simulation-based applications, and digital learning platforms has been proven to assist students in grasping complex material, enhance their motivation, and foster critical thinking skills. Accordingly, this study suggests that Edutech serves as a vital bridge that links traditional pedagogical needs with the demands of 21st-century digital literacy.

The implications of this study extend beyond the local context of South Lampung and resonate more broadly within Indonesian education. In the era of digital disruption, technology-based learning is no longer an optional supplement but a necessity. The findings of this research are expected to serve as a reference for schools in other regions to take more serious steps in integrating technology into learning, while also providing a foundation for policymakers to design inclusive digital education policies. Moreover, the prospects for future research may include the development of more adaptive hybrid learning models, where conventional methods and digital technologies are blended according to the characteristics of students and school conditions. Such models have the potential to offer more flexible and personalised approaches, enabling education to respond more effectively to the diversity of contexts across Indonesia.

Future studies should be expanded by involving a larger sample of schools from different regencies or provinces, in order to obtain a more representative picture of the variations in Edutech utilisation across regions. Longitudinal research is also essential to assess the long-term effects of Edutech on academic achievement, 21st-century skills, and students' readiness for the workforce. In addition, given the significant role of teachers in determining the success of technology integration, further exploration into strategies for developing teachers' digital competence constitutes an important agenda for subsequent research.

This study has not only addressed the research question posed in the introduction concerning the extent to which differences in Edutech utilisation between public and private schools affect mathematics learning outcomes, but it has also provided a deeper understanding of its implications. Edutech has been shown not only to improve learning outcomes but also to shape a more interactive, collaborative, and digitally relevant learning ecosystem. Ultimately, ensuring the equitable strengthening of Edutech use across all schools will be a strategic step towards guaranteeing that every student, regardless of school type or socio-economic background, has equal opportunities to achieve academic success and master the competencies required in the 21st century.

REFERENCES

[1] H. S. Al-zboon, A. M. Gasaymeh, and M. S. Al-Rsa'i, "The attitudes of science and mathematics teachers toward the integration of information and communication technology in their educational practice: The Application of the Unified Theory of Acceptance and Use of Technology (UTAUT)," World Journal of Education, vol. 11, no. 1, pp. 75–90, 2021.

[2] D. P. Ausubel, Educational psychology: A cognitive view. New York, NY: Holt, Rinehart and Winston, 1968.

[3] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," MIS Quarterly, vol. 13, no. 3, pp. 319–340, 1989.

[4] E. L. Deci and R. M. Ryan, Intrinsic motivation and self-determination in human behavior. New York, NY: Springer, 1985.

[5] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, "From game design elements to gamefulness: Defining 'gamification,'" in Proc. 15th Int. Academic MindTrek Conf.: Envisioning Future Media Environments, 2017, pp. 9–15, ACM.

[6] D. Elpana, R. Riswandi, and H. Fitriawan, "Tantangan implementasi blended learning di sekolah menengah Lampung," Jurnal Teknologi Pendidikan, vol. 25, no. 2, pp. 77–89, 2023.

[7] S. Ernawati, N. Nurwahidin, and R. Riswandi, "Pelatihan guru dalam pemanfaatan media pembelajaran berbasis teknologi untuk meningkatkan peran fasilitator," Jurnal Pendidikan Matematika, vol. 16, no. 1, pp. 45–58, 2022.

[8] A. Farhan and I. G. Sudatha, "Multimedia interaktif berbasis realistic mathematics education untuk meningkatkan pemahaman konsep matematika," Jurnal Edutech, vol. 12, no. 2, pp. 101–115, 2023.

[9] M. Fitrah, A. Setiawan, R. Widihastuti, Y. Marinding, and A. Herianto, "Infrastruktur dan pelatihan guru sebagai faktor penentu keberhasilan integrasi teknologi digital di Indonesia timur," Jurnal Inovasi Pendidikan, vol. 8, no. 1, pp. 55–69, 2024.

[10] H. Julianto, A. Efendi, and G. Gunarhadi, "Pengembangan ethnomatematika berbasis Android

untuk pembelajaran geometri di sekolah menengah," Jurnal Riset Pendidikan Matematika, vol. 11, no. 1, pp. 34–47, 2024.
[11] T. S. Melinda, E. Partasiwi, and K. Kirana, "Penggunaan aplikasi Android dalam pembelajaran matematika di SMP Negeri 13 Bandar Lampung," Jurnal Pendidikan Matematika, vol. 15, no. 2, pp. 88–97, 2022.
[12] R. Noviyanti, I. Sugiharta, and F. Farida, "Blended learning berbasis Edmodo untuk meningkatkan kemampuan pemecahan masalah matematis siswa," Jurnal Pendidikan Matematika UIN Raden Intan Lampung, vol. 10, no. 2, pp. 121–134, 2021.
[13] J. Piaget, The psychology of the child. New York, NY: Basic Books, 1972.
[14] A. Prasetyo and R. Nugroho, "Kualitas infrastruktur teknologi sekolah dan pengaruhnya terhadap hasil belajar siswa," Jurnal Pendidikan Indonesia, vol. 7, no. 3, pp. 201–213, 2021.
[15] N. Rahma and E. Nurlaelah, "Dampak teknologi digital terhadap pencapaian matematika siswa di Indonesia: Sebuah meta-analisis," Jurnal Pendidikan Matematika, vol. 17, no. 1, pp. 23–39, 2023.
[16] F. Rahmawati, "Pelatihan guru dalam pengembangan pembelajaran berbasis teknologi," Jurnal Teknologi dan Pembelajaran, vol. 10, no. 2, pp. 66–78, 2022.
[17] R. Rahmadhani, "Pengembangan e-modul interaktif berbasis etnomatematika Lampung untuk materi bangun ruang sisi datar," Jurnal Pendidikan dan Kebudayaan, vol. 7, no. 2, pp. 142–156, 2022.
[18] F. Rahmawati, K. Kirana, and E. Partasiwi, "Efektivitas GeoGebra dalam pembelajaran matematika SMA di Bandar Lampung," Jurnal Inovasi Pendidikan Matematika, vol. 14, no. 3, pp. 98–110, 2023.
[19] E. M. Rogers, Diffusion of innovations, 5th ed. New York, NY: Free Press, 2003.
[20] D. A. Sari and R. Dewi, "Pengaruh penggunaan teknologi dalam pembelajaran matematika terhadap kemampuan berpikir kritis siswa," Jurnal Riset Pendidikan, vol. 12, no. 1, pp. 77–86, 2020.
[21] J. Setälä, N. Heilala, E. Sikström, and T. Kärkkäinen, "Adoption of generative AI in mathematics education: A diffusion of innovations perspective," Journal of Educational Research, vol. 118, no. 2, pp. 145–161, 2025.
[22] L. S. Vygotsky, Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press, 1978.
[23] B. Yildirim, O. Bektas, and A. Erdem, "Preservice mathematics teachers' intention to use technology: An application of the Technology Acceptance Model," International Journal of Education in Mathematics, Science and Technology, vol. 9, no. 3, pp. 411–426, 2021.
[24] R. Yunita and I. Wardani, "Persepsi guru terhadap manfaat teknologi dalam pembelajaran matematika," Jurnal Pendidikan Matematika Indonesia, vol. 4, no. 2, pp. 56–65, 2019.