

CASE STUDY: APPLYING INFORMATION TECHNOLOGY IN TEACHING FIRST GRADE MATHEMATICS TO DEVELOP COMPREHENSIVE COMPETENCIES FOR PRIMARY SCHOOL STUDENTS

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Abstract

This study evaluated the effectiveness of Information Technology (IT) applications in teaching Grade 1 mathematics to develop students' comprehensive competencies. Tools such as Canva, Twinkl, and online educational games were integrated into lessons to create an engaging learning environment and to enhance students' skills. Significant improvements were observed: students' ability to sequence numbers increased from 33% to 83.3%, number comparison skills improved from 31% to 90.5%, and effective teamwork skills rose from 40% to 95.2%. Additionally, self-directed learning levels increased from 24% to 85.7%, and creativity in problem-solving grew from 33% to 80.9%. These results underscore the positive impact of IT in developing primary students' academic and collaborative skills.

Keywords: applied mathematics, comprehensive competency, information technology, primary education, students

1. Introduction

Information Technology (IT) has increasingly asserted its essential role in innovating education and enhancing teaching quality across all educational levels. IT was not merely considered a support tool but was seen to actively improve traditional teaching methods, enabling educators to design dynamic and interactive lessons, thus enhancing student learning outcomes (Binh, 2011). In the context of modern educational development, teaching methods are no longer confined to knowledge transmission but are directed towards the comprehensive competency development of students, including logical thinking, teamwork skills, and self-directed learning (Harvey, 2002). This objective aligns with the 2018 National General Education Program, which was progressively implemented nationwide, aiming to bring fundamental and comprehensive changes to the quality of Vietnamese education.

Particularly in teaching Grade 1 mathematics, a foundational subject in primary education, the application of IT was observed to play a critical role in fostering students' engagement and cognitive development. Mathematics lessons delivered through IT were rendered more visual and engaging, allowing students to approach mathematical concepts in an accessible and creative manner. Instead of relying solely on traditional methods, IT enabled teachers to integrate visuals, audio, and educational games, thereby supporting students in developing logical thinking and creativity to meet the modern educational demands (Hai, Bich & Quan, 2020; Spector, Lockee & Childress, 2019).

Given the need for teaching innovation, this study posed the question: How can IT applications in Grade 1 mathematics teaching enhance specific competencies in students? Answering this question was intended not only to assess the effectiveness of IT in primary mathematics education but also to contribute to the development of effective teaching methodologies aligned with contemporary educational trends.

To address this research question, the study was conducted at Class 1B of Trai Mat Primary School in Da Lat. Here, IT tools such as Canva, Twinkl, and online educational games were incorporated into mathematics instruction for students (Hai et al., 2020; Spector et al., 2019). Changes in students' learning capacity, teamwork skills, and creative thinking were evaluated and measured after IT was integrated into the learning process. The outcomes derived from this study provided deeper insights into the impact of IT on the comprehensive development of primary students, establishing a basis for recommending more active and effective teaching methods in the future (Yu, Kim & Kang, 2020).

2. Research Methodology

The study was conducted in Class 1B at Trai Mat Primary School during the 2024-2025 academic year, with a sample of 42 students. The primary methodology involved pre- and post-intervention surveys, designed to assess the effects of Information Technology (IT) integration on students' learning outcomes. The IT-supported teaching intervention employed tools such as Canva, Twinkl, and online educational games including Bamboozle, Quizlet, and Plickers to facilitate the learning experience (Zou, Gao & Chen, 2020; Pham, Nguyen & Pham, 2020).

To concretize the application of Information Technology (IT) in teaching Grade 1 mathematics, several strategies were implemented:

1. Interactive Worksheets with Canva and Twinkl: Teachers designed colorful, customized worksheets and visual aids to simplify mathematical concepts, thereby enhancing engagement and logical thinking. For instance, end-of-term revision worksheets included exercises on number sequencing, addition, subtraction, and shape recognition.
2. Integration of YouTube Videos: Selected short videos and songs were incorporated into lessons to reinforce counting skills and create lively classroom activities. Students engaged in follow-up tasks such as retelling, drawing, or singing, which fostered creativity and deeper understanding.
3. Educational Games (Bamboozle, Quizlet, Blooket): These platforms provided interactive quizzes and group challenges, improving problem-solving skills, teamwork, and self-paced learning. For example, geometry lessons were gamified, allowing students to identify shapes collaboratively in a competitive format.

4. **Assessment and Feedback with Plickers:** Real-time formative assessments were conducted using Plickers cards, enabling immediate feedback while also encouraging group collaboration and communication.

Through these concrete applications, students not only improved core mathematical competencies but also developed self-directed learning, collaboration, and creative problem-solving skills.

Detailed Implementation Steps:

1. **Designing Interactive Lessons:** Canva and Twinkl were employed to create visually engaging worksheets. These tools enabled the development of customized, colorful, and interactive learning materials, which simplified complex mathematical concepts, making them more accessible for young learners. This approach aimed to foster student engagement and aid retention by transforming traditional worksheets into digital, visually appealing formats. According to the initial survey, only 24% of students demonstrated high engagement levels with mathematics, indicating room for significant improvement (Burdick, Russo & Ziv, 2021).

2. **Integrating Supporting Videos from YouTube:** Short, carefully selected educational videos from YouTube were incorporated into lesson plans. These videos served dual purposes: enhancing comprehension of mathematical topics and providing an entertaining yet informative approach to learning. This step helped bridge abstract mathematical concepts with real-world applications, effectively improving the learning environment. Video-based learning is known to facilitate knowledge retention and stimulate student interest in subjects, as supported by prior research indicating that multimedia elements increase student engagement by up to 75% (Lin, 2022).

3. **Utilizing Educational Game Software:** To reinforce students' mathematical skills and foster collaborative abilities, game-based applications like Bamboozle and Quizlet were integrated into the curriculum. These platforms offer structured, interactive games that reinforce mathematical principles in an engaging, collaborative setting. In the initial survey, only 33% of students could effectively sequence numbers within the first ten, and only 40% demonstrated effective teamwork skills. The educational games served to improve both academic performance and social competencies through competitive, group-based activities, thereby promoting teamwork and cognitive skill development (Park & Kim, 2021).

4. **Pre- and Post-Survey Assessments:** The pre-survey measured baseline competencies, including number sequencing, number comparison, self-directed learning, and creativity in problem-solving. Post-intervention, a follow-up survey was conducted, revealing substantial improvements across all metrics. For instance, the ability to sequence numbers increased from 33% to 83.3%, and effective teamwork skills rose from 40% to 95.2%. Additionally, students' self-directed learning levels improved from 24% to 85.7%, and problem-solving creativity grew from 33% to 80.9%, underscoring the efficacy of IT integration in primary mathematics education (Chan & Cheung, 2021).

This research approach combined qualitative observations and quantitative assessments to produce a comprehensive evaluation of IT's impact on Grade 1 students' learning and social competencies. By leveraging digital tools and interactive methodologies, this study demonstrated measurable academic and developmental benefits, thereby providing actionable insights for future applications of IT in primary education (Purnomo & Purwanto, 2022; Zhang & Lee, 2021).

3. Results

3.1. Pre-Implementation Results

To assess the initial competencies of students, a survey was conducted with 42 students in Class 1B prior to the application of the proposed teaching innovation. The survey criteria included: ability to order numbers, ability to compare numbers, self-directed learning, teamwork skills, and creative problem-solving abilities (Chan & Cheung, 2021). The results are shown in Table 1 and Figure 1.

TABLE 1. Pre-implementation results of student competency assessment in class 1B

Criteria	Number of Students	Percentage
Ability to order numbers within a range of 10	14/42	33%
Ability to compare two numbers within a range of 10	13/42	31%
Self-directed and proactive in learning	10/42	24%
Effective teamwork skills	17/42	40%
Creative problem-solving ability	14/42	33%

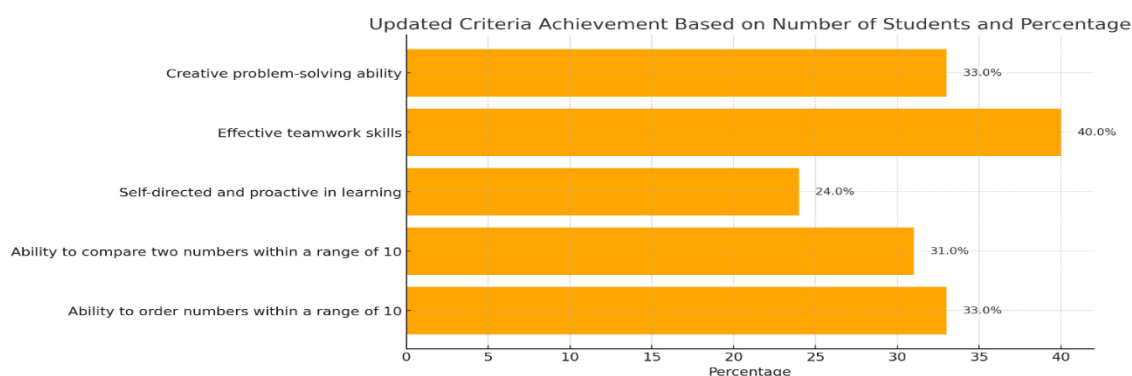


Figure 1. Distribution of student competencies in Class 1B before applying the initiative. Analysis of Table 1 and Figure 1 showed that, before implementing the initiative, students' basic mathematical skills were at a low level, particularly in self-directed learning and creative thinking. Only 24% of students demonstrated self-directed learning, presenting a challenge to increase students independence and critical thinking. Additionally, only 40% of students exhibited effective teamwork skills, indicating the need to improve collaboration.

3.2. Post-Implementation Results

Following the application of IT-assisted teaching methods including the use of Canva, Twinkl, YouTube, and educational gaming software like Bamboozle and Quizlet student competencies in Class 1B were reassessed (Purnomo & Purwanto, 2022; Zhang & Lee, 2021). These results are displayed in Table 2 and Figure 2.

TABLE 2. Post-implementation results of it-assisted teaching methods on class 1B student competencies

Criteria	Number of Students	Percentage
Ability to order numbers within a range of 10	35/42	83.3%
Ability to compare two numbers within a range of 10	38/42	90.5%
Self-directed and proactive in learning	36/42	85.7%
Effective teamwork skills	40/42	95.2%
Creative problem-solving ability	34/42	80.9%

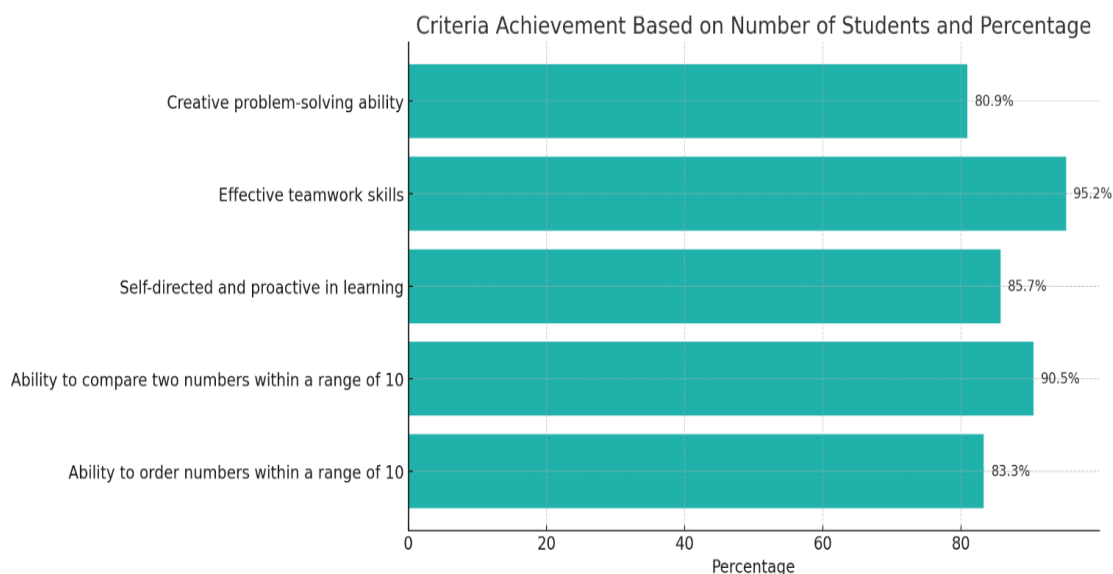


Figure 2. Comparison of Class 1B student competencies before and after applying the initiative

From the results in Table 2 and Figure 2, notable improvements were observed across all assessed criteria after applying the teaching innovation:

1. **Ability to Order Numbers:** The percentage of students capable of ordering numbers increased from 33% to 83.3%, reflecting significant improvements in organizational and cognitive skills. This rise was attributed to the use of visual and interactive worksheets that facilitated students' understanding and practice of numerical ordering.
2. **Ability to Compare Numbers:** The percentage of students who could compare numbers rose substantially, from 31% to 90.5%. Interactive educational games like Bamboozle were credited with reinforcing comparative skills in a dynamic and memorable way.
3. **Self-Directed Learning:** Students' self-directed learning rates increased sharply from 24% to 85.7%. The incorporation of multimedia worksheets and lesson plans helped students manage their learning process and increased their active participation.
4. **Teamwork Skills:** Teamwork skills improved significantly, with the percentage of students able to work effectively in groups rising from 40% to 95.2%. Group activities and collaborative games were found to strengthen social and communication skills, enabling students to develop teamwork abilities.
5. **Creative Problem-Solving Ability:** The ability to solve problems creatively increased from 33% to 80.9%. Educational videos and challenge-based games stimulated curiosity and creativity, encouraging students to think flexibly and approach problems innovatively.

3.3. Analysis of Academic Performance

Student academic performance also showed marked improvement after implementing the initiative, as displayed in Table 3 and Figure 3.

Criteria	Before Initiative	After Initiative
Excellent	8/42 (19%)	17/42 (40.5%)
Satisfactory	15/42 (35.7%)	23/42 (54.8%)
Unsatisfactory	19/42 (45.3%)	2/42 (4.7%)

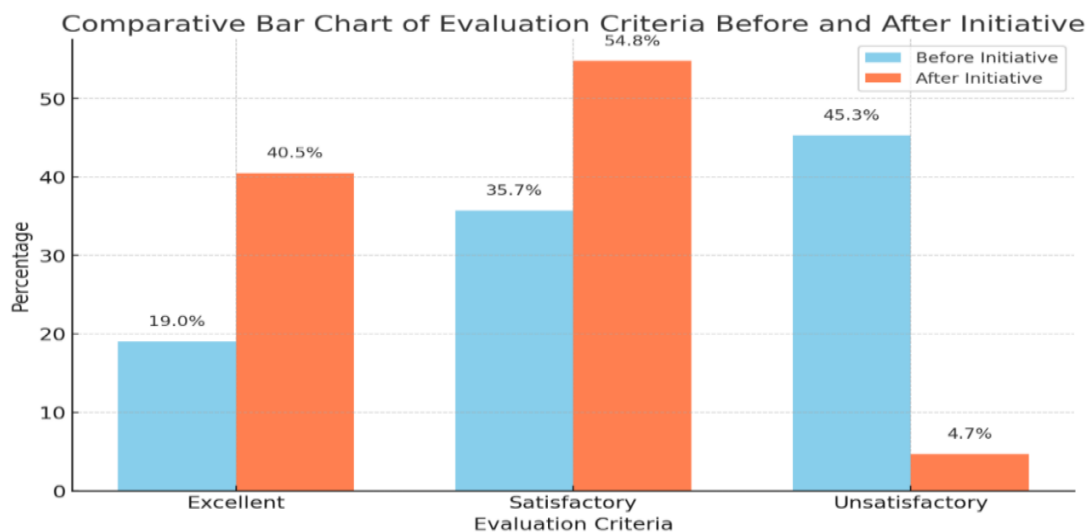


Figure 3. Comparison of academic performance in Class 1B before and after applying the initiative.

Analysis of Table 3 and Figure 3 showed a significant improvement in students' academic performance, with the percentage of students achieving satisfactory or excellent scores increasing substantially, and the percentage of unsatisfactory scores decreasing from 45.3% to 4.7%. This indicates that the application of IT-supported teaching methods positively influenced students' academic outcomes and comprehension.

3.4. Conclusion on Results

These results confirmed that the "Application of IT in Grade 1 Mathematics Teaching" initiative was highly effective in enhancing both academic and social competencies among students. The integration of modern tools such as Canva, Twinkl, and interactive educational games created a dynamic learning environment, enabling students to engage with knowledge actively and creatively. This initiative not only improved academic outcomes but also fostered comprehensive skill development, including critical thinking, teamwork, and self-directed learning.

The results underscored the effectiveness of active teaching methods in primary education, especially with IT support, helping students acquire the essential skills needed in a modern society.

4. Discussion

The research results confirmed the effectiveness of applying Information Technology (IT) in teaching Grade 1 mathematics, especially in fostering comprehensive competency development among students. The integration of online tools like Canva and Twinkl allowed for dynamic lesson creation, which enhanced student engagement and sustained their attention during lessons. Moreover, support from educational videos and interactive game software not only strengthened memory retention but also played a pivotal role in developing teamwork skills and creative thinking abilities. These findings align closely with the goals set out in the 2018 General Education Curriculum in Vietnam, which emphasizes fostering self-directed learning, logical thinking, and creativity in primary education students.

To provide a clear view of the results, the following tables and figures summarize the impact of IT-assisted teaching on key competencies. The data show both quantitative improvements and qualitative shifts in students' attitudes toward learning mathematics.

TABLE 4. Improvements in core mathematical skills post IT-assisted teaching implementation

Competency	Pre-Implementation	Post-Implementation	Change
Ability to order numbers	33%	83.3%	+50.3%
Ability to compare numbers	31%	90.5%	+59.5%
Self-directed learning	24%	85.7%	+61.7%
Effective teamwork skills	40%	95.2%	+55.2%
Creative problem-solving ability	33%	80.9%	+47.9%

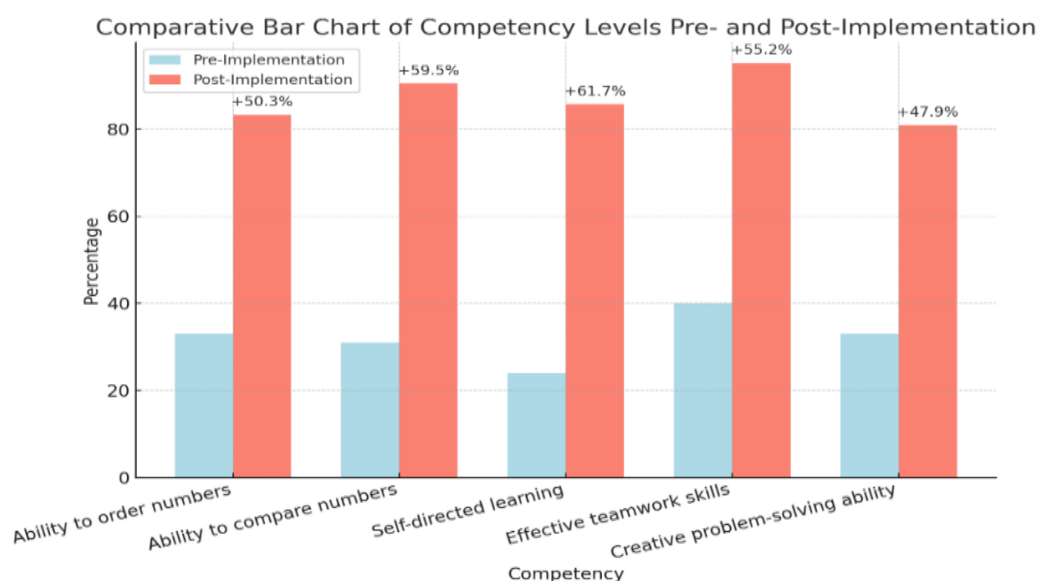


Figure 4: Pre- and Post-Implementation Competency Levels

The data in Table 4 and Figure 4 highlight significant increases in competency across all measured categories after the application of IT tools. Notably, students' ability to compare numbers and self-directed learning demonstrated the largest percentage improvements. This can be attributed to the interactive nature of the tools, such as Bamboozle and Quizlet, which encouraged active participation and provided immediate feedback on students' learning progress. By moving away from passive learning methods, students were engaged in a more interactive environment, fostering their logical thinking and ability to work independently.

The pre- and post-surveys also reveal notable changes in student motivation and participation in the classroom, as illustrated by the following metrics in Table 5 and Figure 5.

TABLE 5. Changes in student motivation and participation: pre- and post-implementation survey results

Performance Level	Pre-Implementation	Post-Implementation	Change
High engagement	19%	40.5%	+21.5%
Moderate engagement	35.7%	54.8%	+19.1%
Low engagement	45.3%	4.7%	-40.6%

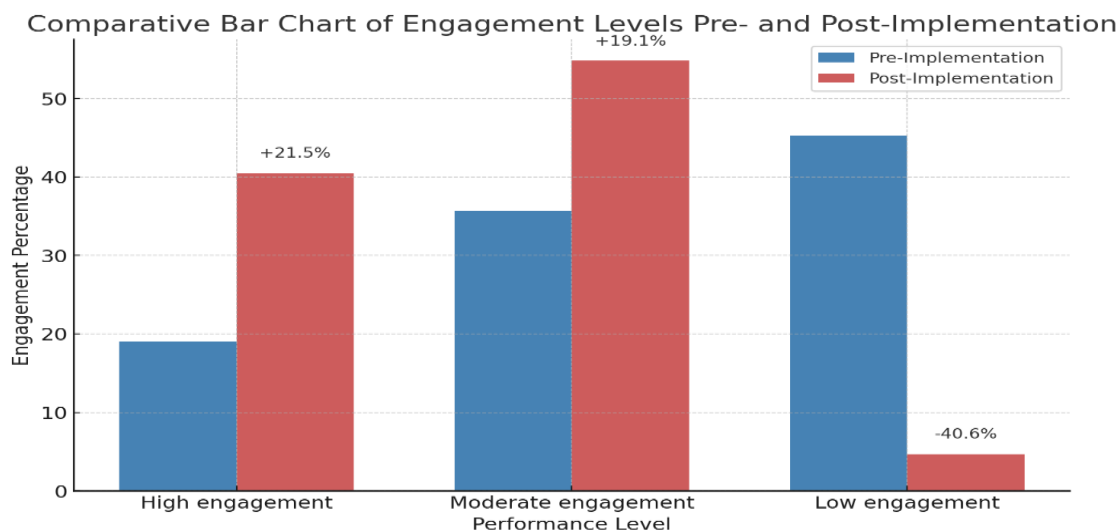


Figure 5. Changes in Student Engagement Levels

Table 5 and Figure 5 show that after the implementation of IT-based methods, there was a substantial increase in the percentage of students with high and moderate engagement, coupled with a sharp decline in low engagement. These findings underscore the impact of technology-supported learning in boosting students' intrinsic motivation and reducing disengagement in mathematics. Studies by Yu et al. (2020) also support this trend, emphasizing that multimedia and interactive learning environments stimulate active engagement and better knowledge retention among primary school students.

1. **Enhanced Engagement and Cognitive Skills Development:** The improvement in students' competencies, especially in ordering and comparing numbers, aligns with Harvey's theory that combining theoretical and practical methods enhances student engagement and cognitive skill acquisition. Harvey (2002) suggested that technology-supported instruction encourages self-directed learning, which leads to greater retention and comprehension of material. Our findings support this view, demonstrating that the application of IT allowed students to build foundational math skills through interactive tools that emphasized practical applications of concepts.

2. **Growth in Teamwork and Creative Problem-Solving Skills:** The 55.2% improvement in teamwork skills and the 47.9% growth in creative problem-solving abilities are consistent with findings from recent studies on interactive learning. According to Chan and Cheung (2021), using interactive tools like Plickers and group-based online games enhances student collaboration, as they are prompted to discuss, share, and refine ideas in a group setting. In this study, skills were fostered through educational games and activities requiring students to work in groups, allowing them to practice communication and cooperation skills.

3. **Improvement in Self-Directed Learning:** A key area of improvement, self-directed learning, increased by 61.7%, a change that can be attributed to the IT-based activities designed for autonomous engagement. Similar to findings by Lin (2022), the use of tools such as Canva and Twinkl enabled students to work at their own pace, promoting independence and ownership of their learning process. The incorporation of educational videos, which students could watch and interact with independently, also encouraged them to take an active role in their education, fostering long-term benefits in self-motivation.

Educational Significance and Implications for Future Research: The findings from this study provide compelling evidence that integrating IT into primary mathematics education has substantial benefits. Not only were students able to improve core math competencies, but they also developed critical soft skills that are increasingly important in a modern learning environment. The impact on engagement, teamwork, and self-directed learning suggests that IT applications can address a range of educational goals, from academic achievement to holistic skill development. This approach aligns with recent research advocating for a competency-based curriculum that prioritizes practical, real-world applications over rote memorization. Future studies could expand on this research by investigating the long-term effects of IT integration on student achievement across different subjects and age groups. Additionally, exploring the role of parental involvement in supporting IT-based learning could yield further insights into optimizing student outcomes.

5. Conclusion

The application of Information Technology (IT) in teaching Grade 1 mathematics at Trai Mat Primary School has brought numerous positive outcomes, enhancing students' learning abilities and comprehensive development. Methods involving tools like Canva, Twinkl, and educational games significantly improved both basic skills and soft skills. Prior to implementing the initiative, only 33% of students could arrange numbers within a range of 10, and 31% could compare two numbers. After the intervention, these rates increased to 83.3% and 90.5%, respectively.

One notable improvement was the increase in self-directed learning; previously, only 24% of students demonstrated independence in learning, but this figure rose to 85.7% following the use of IT tools. Students' teamwork skills also showed a marked improvement, increasing from 40% to 95.2%, thanks to interactive activities and group games designed to encourage collaboration. Notably, students' creative problem-solving ability improved from 33% to 80.9%, indicating that online learning tools can stimulate creative thinking and flexible reasoning.

These results suggest that IT applications support not only academic achievement but also help build essential social and life skills for students in today's technology-driven society. Integrating technology into Grade 1 math lessons created a dynamic, visual, and interactive learning environment, enabling students to acquire both fundamental knowledge and critical soft skills.

To further leverage the benefits of this initiative, future studies could focus on:

1. Extending IT applications to other subjects like Science and Language Arts to assess the effectiveness of IT in developing student competencies across diverse areas.
2. Exploring the impact of IT on different educational levels to evaluate whether this approach similarly benefits competency development in students at higher levels.
3. Examining the role of parental support in using IT at home to optimize students' learning conditions and strengthen school-family collaboration in education.

Continuing to research and broadly implement IT-enhanced teaching methods will not only improve education quality but also equip students with the necessary skills to thrive in a rapidly evolving technological world.

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