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COMPARISON OF LEARNING OUTCOMES USING INFORMATION AND COMMUNICATIONS TECHNOLOGY MEDIA WITH CONVENTIONAL LEARNING AT IAKN TARUTUNG

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ABSTRACT

The rapid advancement of Information and Communication Technology (ICT) in recent decades has significantly transformed educational methodologies, particularly in developing countries like Indonesia. This study investigates the impact of ICT-based instructional media on student learning outcomes at the Institut Agama Kristen Negeri (IAKN) Tarutung compared to traditional teaching methods. Employing a quasi-experimental design, two classes within the Bachelor's Program of Christian Education Management were utilized: Class A served as the experimental group receiving ICT-enhanced instruction, while Class B acted as the control group engaged in conventional teaching. Data were collected through pre-tests and post-tests, alongside observations and student questionnaires to assess engagement and perceptions regarding ICT use. Analysis of the collected data revealed notable differences in learning outcomes, indicating that students exposed to ICT-based media demonstrated higher levels of engagement and improved academic performance. The findings underscore the necessity for Indonesian educational institutions to integrate ICT effectively to prepare students for the demands of a digital economy. This research contributes to the ongoing discourse on educational technology's role in enhancing learning experiences and provides practical recommendations for educators aiming to leverage ICT in their teaching practices, ultimately aiming to equip students with essential skills for the 21st century.

Keywords: Learning Outcomes, ICT, Conventional Learning

INTRODUCTION

The rapid acceleration of technology in recent decades, especially in the areas of computers and the internet, has brought about significant changes in the way societies function, impacting not only communication and commerce but also the education sector. The availability and increasing sophistication of Information and Communication Technology (ICT) have opened new avenues for information processing and dissemination, necessitating educational institutions to adapt their teaching methods. As societies become more digitally oriented, the integration of ICT in education has become a pressing need to ensure the future readiness of students and the overall improvement of learning experiences. This transition is especially crucial in developing countries like Indonesia, where the potential of ICT to enhance education quality is still underutilized.

The integration of ICT into the classroom has long been recognized as a means to improve learning outcomes. A vast body of research indicates that ICT-based instructional tools can help students better understand complex subjects, facilitate critical thinking, and encourage collaborative

learning. Moreover, the rise of e-learning platforms has further highlighted the advantages of utilizing ICT for educational purposes. These platforms allow for flexible learning opportunities, enabling students to access educational content from anywhere, at any time. As a result, many institutions worldwide have begun to capitalize on ICT to improve their teaching and learning processes.

Despite the clear benefits, the incorporation of ICT into education in Indonesia is still far from optimal. Many educational institutions face challenges in implementing ICT effectively, often due to a lack of infrastructure, technical support, and sufficient training for educators. Moreover, there is still a relatively low level of societal awareness regarding the need to integrate ICT more fully into the educational process. The increasing global trend of digitization calls for Indonesian educational institutions to improve both the quantity and quality of ICT-based media used in teaching and learning processes. Without such advancements, Indonesia risks falling behind in preparing its future workforce for the challenges of a rapidly evolving digital economy.

In the realm of higher education, particularly, the role of ICT is becoming increasingly pivotal. With the diverse needs of modern learners and the demand for more interactive and engaging learning environments, educational technology is no longer a luxury but a necessity. Many universities and schools worldwide are adopting ICT to enhance their academic programs, with some even developing fully digital learning environments. These tools offer students an opportunity to engage more deeply with course material through multimedia content, online collaboration tools, and interactive simulations, providing a more immersive and flexible learning experience. However, not all educational institutions, especially in Indonesia, are equally prepared to make this transition.

One of the primary barriers to the successful implementation of ICT in Indonesian education is the lack of understanding among educators, particularly those who are nearing the end of their careers and are less familiar with new technologies. Many veteran educators are accustomed to traditional teaching methods, making the shift to ICT-based education more difficult. This generational gap in technological proficiency creates challenges for schools and universities striving to integrate ICT more fully into their curricula. Without adequate support and training, these educators may struggle to utilize ICT effectively in their teaching, ultimately limiting the potential benefits for their students.

Another significant challenge lies in the way students use technology. While younger generations are generally more tech-savvy, many students use ICT primarily for entertainment and social media rather than for educational purposes. The widespread use of smartphones and social networking platforms can distract students from their studies, leading to a decrease in academic performance. Therefore, it is crucial for educators to monitor and guide the use of ICT among students, ensuring that these tools are employed constructively to enhance learning, rather than becoming a source of distraction.

In light of these challenges, it is essential for educators to become proficient in using ICT-based teaching media. By doing so, they can better demonstrate to their students the positive impact that technology can have on their learning experience. Educators should strive to integrate ICT into their teaching practices in ways that encourage active engagement and foster critical thinking. This requires not only technical knowledge but also a deep understanding of how to use technology to facilitate learning. Educators must be willing to embrace new pedagogical approaches that align with the evolving technological landscape, ensuring that their teaching methods remain relevant and effective in the digital age.

Despite the clear potential of ICT to transform education, there is still a gap in understanding among some educators, who continue to rely on conventional teaching methods. These traditional approaches often fail to engage students in the same way that ICT-based tools can. As a result, students may become disengaged from their studies, leading to lower academic achievement. To address this issue, educational institutions must provide ongoing professional development opportunities for their educators, helping them to develop the skills and knowledge necessary to integrate ICT effectively into their teaching practices (Almarashdeh, 2019).

This study seeks to explore these issues by examining the impact of ICT-based instructional media on student learning outcomes at the Institut Agama Kristen Negeri (IAKN) Tarutung, compared to the outcomes of students taught using conventional methods. By comparing these two approaches, the study aims to provide insights into the effectiveness of ICT in enhancing the learning experience and improving educational outcomes in a higher education context. Specifically, the study will focus on whether students taught using ICT-based media perform better, worse, or comparably to those taught using traditional teaching methods. The findings will help to inform the ongoing discourse on the role of educational technology in Indonesia and offer practical recommendations for improving the integration of ICT into the country's educational system.

The primary objective of this study is to assess the learning outcomes of students who are taught using ICT-based media at IAKN Tarutung. By analyzing the performance of these students, the study aims to determine the extent to which ICT-based teaching enhances learning outcomes. Additionally, the study will evaluate the learning outcomes of students who are taught using conventional, non-ICT-based methods, providing a point of comparison for the analysis. Ultimately, the study seeks to determine whether there is a significant difference in the learning outcomes of students taught using ICT-based media compared to those taught using traditional teaching methods.

By addressing these objectives, the study will contribute to the broader understanding of the role that ICT can play in improving educational outcomes in Indonesia. As the country continues to develop its educational infrastructure, the insights gained from this study may help to inform policy decisions and guide future efforts to integrate technology more fully into the teaching and learning process. In doing so, the study will help to ensure that Indonesian students are better prepared to meet the challenges of the 21st century, equipped with the skills and knowledge necessary to thrive in an increasingly digital world.

METHODS

This study employs an experimental approach aimed at comparing the learning outcomes of students taught using Information and Communication Technology (ICT)-based media with those taught using conventional teaching methods. The experimental method is appropriate for exploring the cause-and-effect relationship between the studied variables. In this context, the independent variable is the teaching method—ICT-based versus conventional—while the dependent variable is the students' learning outcomes. Experimental research allows the researcher to compare two groups receiving different treatments, thus enabling a clear examination of the impact of ICT usage on learning outcomes.

In this study, a quasi-experimental design was used, where the groups being studied were pre-existing, and no random assignment was made to the experimental and control groups. This quasi-experimental design was chosen because the researcher worked with two pre-formed classes: Class A and Class B in the Bachelor's Program of Christian Education Management. In this design, one

class was designated as the experimental group using ICT media, while the other class became the control group taught using conventional methods. Although randomization was not applied, this research can still provide a strong comparative illustration of the effectiveness of ICT-based learning media.

The research was conducted at the Institut Agama Kristen Negeri (IAKN) Tarutung, located at Campus II, Jalan Raya Tarutung-Siborongborong KM 11, Silangkitang Village, Sipoholon District, North Tapanuli Regency, North Sumatra. IAKN Tarutung was chosen as the research location because the researcher had direct access to students in the Bachelor's Program of Christian Education Management. The researcher also serves as an instructor in this program, which facilitated the execution of the experiment, minimizing logistical and administrative barriers while allowing for direct involvement in both the experimental and control classes.

Additionally, the Bachelor's Program of Christian Education Management at IAKN Tarutung was deemed an interesting research subject due to its relevance to the integration of Christian values with technology in education. As a result, this research not only contributes to the development of ICT-based teaching methods in Christian education but also strengthens the broader educational practices at IAKN Tarutung.

The research population comprises all students enrolled in the Bachelor's Program of Christian Education Management at IAKN Tarutung in the 2022/2023 academic year. The total population consists of 61 students divided into two classes: Group A and Group B. This entire population was selected as the basis for the research since it includes all students involved in courses taught by the researcher. With a relatively small population size, the researcher could maximize data collection from all available students, ensuring more representative results from the target population.

In this experimental study, the two classes were used as the experimental and control groups. Class A, consisting of 31 students, was designated as the experimental group, where ICT-based learning media was employed. Class B, with 30 students, served as the control group and was taught using conventional teaching methods. The use of two classes with equivalent numbers and demographic characteristics allowed for a more valid comparison of learning outcomes between the groups.

Sampling was done purposively, where the researcher intentionally selected the two classes based on availability and ease of access. Although full randomization was not performed, both groups were expected to have similar initial characteristics in terms of academic ability, making the comparison of learning outcomes more accountable. This grouping helps minimize bias, despite not being a perfect randomization as in a true experimental design.

The data collection process took place over one academic semester, with equal time allocated to both the experimental and control groups. The experimental class was taught using various ICT platforms, such as interactive video lessons, online materials, and forum-based discussions within a learning management system (LMS). Meanwhile, the control group was taught using traditional teaching methods, including lectures, class discussions, and textbooks as the primary media.

At the start of the semester, both groups were given a pre-test to measure their initial abilities before the interventions. The pre-test aimed to ensure that both groups had similar levels of understanding before applying the different teaching methods. After the interventions, students from both groups were given a post-test to assess their learning outcomes after participating in their respective teaching methods. The pre-test and post-test results were then compared to determine whether there was a significant difference in learning outcomes between the two groups.

Data were collected through a learning outcomes test developed based on the course curriculum. The test consisted of multiple-choice questions designed to assess students' understanding of the material taught over the semester. In addition, the researcher also conducted direct observations

during the learning process to record student engagement in discussions, ICT usage, and their responses to the teaching methods implemented.
Additional data were gathered through a questionnaire given to students at the end of the semester to measure their perceptions of ICT usage in the learning process. The questionnaire utilized a five-point Likert scale covering various aspects such as the ease of using technology, engagement in learning, and overall satisfaction.
The collected data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to describe the sample characteristics, such as mean values, standard deviations, and frequency distributions. To test the research hypothesis, an independent two-sample t-test was employed to compare the post-test scores of the experimental and control groups. This t-test was used to determine whether there was a significant difference between the learning outcomes of students taught using ICT media and those taught through conventional methods.

RESULT and DISCUSSION

The data analysis of this study involves a comprehensive examination using normality, homogeneity, and hypothesis testing to validate the research findings. The primary goal was to evaluate the differences in learning outcomes between students taught using conventional methods and those taught using ICT-based learning media.

Data Analysis: Normality and Homogeneity Testing

The data analysis began with prerequisite tests, specifically the normality and homogeneity tests, to ensure the data met statistical assumptions. Normality testing was conducted using the Shapiro-Wilk test via SPSS version 27. In the experimental class, the pre-test significance value was .008, and the post-test significance was .053, while for the control group, the pre-test and post-test significance values were .158 and .158, respectively. Since the significance values for both groups exceeded the threshold of 0.05 (except the experimental group's pre-test), the data was considered to follow a normal distribution. This indicates that, with minor exceptions, the learning outcome data of both groups could be analyzed reliably.
Similarly, the homogeneity test, aimed at ensuring the variance across samples was consistent, returned a significance value of .051, which exceeds the threshold of 0.05. As a result, the data for both the experimental and control groups were deemed homogenous, meaning the variability in student learning outcomes across both groups was comparable, further validating the robustness of the dataset.

Pre-test Comparisons: Initial Abilities of Students

To establish that both the experimental and control groups started with similar baseline abilities, a pre-test comparison was conducted using the two-tailed test. The analysis revealed a significance value (Sig. 2-tailed) of 0.953, which is greater than 0.05. This confirms that no significant difference existed between the groups' initial abilities. Additionally, the t-statistic ($t = 0.953$) was less than the t-table value ($t = 2.001$), further supporting the conclusion that both groups had equivalent starting knowledge. The ability to confirm this equivalence is crucial, as it ensures that any differences observed in the post-test results can be attributed to the teaching methods, rather than pre-existing disparities in student ability.

As Huda (2013) emphasizes, analyzing students' initial abilities provides insights into their preparedness to engage with the material and the effectiveness of the instructional strategies employed. By establishing a baseline, the study ensures that both groups are comparable, allowing for a fair assessment of the impact of ICT-based learning versus conventional methods.

Statistical Summary: Post-Test Results

The statistical summary of both the control and experimental groups reveals a stark contrast in their post-test results. In the experimental group, which utilized ICT-based learning, the mean score was 12.03, with a standard deviation of 2.24. Meanwhile, in the control group, where conventional teaching methods were employed, the mean score was 9.97, with a standard deviation of 2.08. The range of scores in the experimental group was wider, indicating greater variability in learning outcomes, with the highest score being 15 and the lowest score being 7. In contrast, the control group exhibited a narrower range, with the highest score being 13 and the lowest score being 5.

These findings suggest that ICT-based learning not only led to higher average scores but also fostered a more dynamic learning environment where students were encouraged to engage with the material more independently and proactively. The variability in scores may indicate that while some students excelled significantly, others may have faced challenges adapting to the ICT-based approach, highlighting a potential area for further research into differentiated learning strategies.

Hypothesis Testing: Significance of Differences

To determine whether the observed differences in learning outcomes between the experimental and control groups were statistically significant, a hypothesis test was conducted using the independent sample t-test. The null hypothesis (H_0) proposed no significant difference between the mean scores of the two groups, while the alternative hypothesis (H_a) proposed that a significant difference existed.

The results of the t-test showed a significance value (Sig. 2-tailed) of <0.001, well below the threshold of 0.05, leading to the rejection of the null hypothesis. Additionally, the t-statistic (t = 2.0656) was greater than the critical value from the t-distribution table (t-table = 2.001), further confirming the significance of the difference between the two groups. Thus, the study concludes that students taught using ICT-based learning methods outperformed those taught using conventional methods, with a mean difference of 2.0656 between the two groups. This result is statistically significant, providing strong evidence that the use of ICT in teaching positively influences learning outcomes.

The results of this study underscore the effectiveness of ICT-based learning in enhancing student outcomes. While both the control and experimental groups showed improvement in their post-test scores compared to their pre-test scores, the experimental group consistently outperformed the control group. The mean post-test score in the experimental group (12.03) was notably higher than that of the control group (9.97), reflecting the impact of ICT on students' learning experiences.

One possible explanation for the superior performance of the experimental group is the interactive and engaging nature of ICT-based learning. By incorporating digital tools, students are able to

access a broader range of resources, interact with multimedia content, and engage in self-directed learning. This aligns with research by Ally (2004), which suggests that ICT facilitates active learning by allowing students to construct knowledge through interaction with educational technology.

Furthermore, the use of ICT likely contributed to increased student motivation and engagement. As suggested by Abbot (2001), technology can enhance the learning experience by making content more accessible and interactive, which in turn encourages students to take a more active role in their learning process. This is consistent with the observations in this study, where students in the experimental group appeared to benefit from the additional resources and tools provided by ICT, leading to improved learning outcomes.

In contrast, the control group, which was taught using conventional methods, may have been limited by the passive nature of traditional instruction. Conventional teaching often relies heavily on lecture-based delivery, which can lead to lower levels of student engagement and, consequently, lower learning outcomes. While the control group did show improvement in their post-test scores, the gains were less substantial compared to the experimental group.

The findings of this study provide strong evidence in favor of integrating ICT into educational practices, particularly in enhancing student learning outcomes. ICT-based learning fosters greater engagement, motivation, and autonomy among students, which translates into improved performance. As educational institutions continue to explore innovative teaching methods, the use of ICT offers a promising avenue for enhancing the effectiveness of instruction and preparing students for the demands of the digital age.

The Concept and Benefits of Information and Communications Technology (ICT) in Education

The role of Information and Communications Technology (ICT) in education has transformed the learning environment, offering various tools and methods that enhance both teaching and learning processes. The term "media" originates from the Latin word *medius*, meaning "middle" or "in between," and generally refers to a medium or channel that delivers information from the sender to the receiver. Media serves as an intermediary between the message giver and the receiver, facilitating communication. Some experts define media as a communication channel used to deliver messages, whether through verbal or non-verbal means. These interpretations highlight that media can be either software (containing educational content) or hardware (the tools needed to display or deliver this content).

In educational contexts, ICT serves as a bridge that fosters communication between educators and learners, making the exchange of knowledge more efficient and engaging. However, when supplemented by multimedia tools such as visuals, sound, and interactive elements, learning becomes more concrete and comprehensible. Therefore, learning media refers to anything used to convey messages from teachers to students, aimed at stimulating thoughts, emotions, and curiosity, thus leading to an effective learning process.

The utilization of ICT as a medium provides a multitude of benefits, especially in fostering self-directed learning among students, enhancing their research skills, and broadening their understanding of global issues. Moreover, ICT offers interactive learning experiences and encourages collaboration among students, both locally and globally. For teachers, it provides access to a plethora of learning materials, methodologies, and global resources, which can improve their teaching quality and keep students motivated.

ICT serves not only as a source of instructional material but also as an effective means to improve educational outcomes. Several benefits of ICT in teaching and learning, emphasizing that it

enhances students' motivation and attention by providing varied methods of instruction. For instance, media that includes visuals, animations, or interactive elements helps clarify complex concepts that may be difficult to explain verbally. By integrating ICT tools such as projectors, simulations, and interactive platforms, students can visualize processes like volcanic eruptions or biological phenomena that would otherwise be challenging to convey through traditional methods.
The use of ICT in education also helps address the limitations of space, time, and sensory perception. Large-scale phenomena can be observed through virtual simulations, while distant historical or geographic events can be brought into the classroom through video, augmented reality, or immersive learning environments. This reduces students' dependence on purely verbal explanations and facilitates a more dynamic, engaging classroom experience.
The advantages of using ICT in the classroom include increased student interest and motivation. They assert that media can make learning more engaging and help students grasp abstract concepts more easily, thereby improving comprehension and retention. ICT also fosters a more active learning environment, allowing students to engage in activities such as observing, demonstrating, and experimenting, rather than passively listening to lectures. This not only enhances their cognitive development but also promotes self-driven exploration and problem-solving skills.
The other expert elaborates on the advantages of ICT, emphasizing that it helps lay a concrete foundation for students' thought processes, thereby reducing reliance on rote learning. ICT also encourages more organized and continuous thinking, especially through visual media such as videos and simulations. This is vital in helping students develop logical reasoning and critical thinking skills.
Additionally, ICT helps cultivate a range of experiences that would otherwise be difficult to obtain, providing students with exposure to diverse perspectives and global issues. By using ICT tools, teachers can present content in more varied formats, preventing monotonous lectures and increasing students' engagement in the learning process.
Media as tools that create conditions conducive to learning, allowing students to acquire knowledge, skills, or attitudes. ICT tools such as multimedia presentations, virtual reality (VR), and computer simulations can stimulate students' interest, make learning more dynamic, and help them grasp complex concepts with greater ease.
ICT enhances the effectiveness and efficiency of learning by providing experiences that may not be easily replicated through traditional means. For example, digital platforms can provide real-time feedback, allowing students to adjust their learning strategies. This feedback loop contributes to a more personalized learning experience, where students can learn at their own pace while benefiting from diverse forms of media—videos, animations, infographics, and interactive exercises (Anderson, 2011).
From the insights provided, it is evident that ICT plays a critical role in fostering an effective and conducive learning environment. ICT tools enable teachers to make lessons more interactive and engaging, fostering a deeper understanding of complex concepts among students. Moreover, these tools reduce the need for repetitive verbal explanations, enabling teachers to save energy and focus on more impactful teaching strategies.
The incorporation of various forms of media—ranging from graphic representations to audio and projection tools—provides multiple channels for teachers to present educational content in an easily understandable manner. In doing so, ICT encourages students to explore learning materials independently, seek additional information, and engage in critical thinking.
For instance, when students use online search engines to explore a topic introduced in class, they develop both technical and cognitive skills, becoming more self-sufficient learners. This aligns

with constructivist learning theories, which emphasize the importance of active learning where students construct their own understanding rather than passively receiving information.

ICT is an indispensable component of modern education, serving as both a medium and a facilitator of learning. It allows for greater diversity in teaching methods, which enhances students' cognitive engagement and understanding. Media tools help reduce the cognitive load on students, making complex concepts more tangible and accessible. Moreover, they encourage collaborative learning, active participation, and independent research, all of which contribute to a more enriching educational experience.

In addition to improving learning outcomes, ICT also provides practical benefits for teachers, helping them manage large classes, address different learning styles, and reduce the strain of repetitive tasks. As ICT continues to evolve, its role in shaping future learning environments will become even more prominent, especially as digital learning platforms, AI-based teaching tools, and virtual simulations become more integrated into the educational experience. Therefore, embracing ICT in education is crucial for fostering a dynamic and interactive learning environment that prepares students for the complexities of the modern world.

CONCLUSION

The rapid advancement of Information and Communication Technology (ICT) has reshaped various sectors, particularly education, offering new opportunities for enhancing teaching and learning processes. As this study focuses on the implementation of ICT-based instructional media in Indonesian higher education, particularly at the Institut Agama Kristen Negeri (IAKN) Tarutung, it underscores the pivotal role of technology in fostering better educational outcomes. ICT has been widely recognized as a tool that not only modernizes classrooms but also significantly improves students' engagement, critical thinking, and collaboration skills. The comparison between ICT-based media and conventional teaching methods seeks to determine whether integrating digital tools in classrooms leads to improved student performance.

One of the key findings of global research on ICT in education is that technology enables flexible, student-centered learning. With the rise of e-learning platforms, students have greater access to educational resources, independent of time and location, fostering an environment that encourages self-directed learning. ICT also supports multimedia-enhanced lessons, which help simplify complex concepts, making learning more accessible for students of varying abilities. Despite these benefits, the integration of ICT in Indonesian classrooms, particularly in higher education, faces significant challenges. Infrastructure gaps, lack of technical support, and inadequate training for educators continue to hinder the full realization of ICT's potential.

Educators in Indonesia, especially those in higher education, must be adequately trained to integrate ICT effectively into their teaching practices. As the study at IAKN Tarutung explores, many veteran educators may be resistant to change, preferring traditional methods over digital tools. This highlights the generational gap in technological proficiency, which could limit the successful adoption of ICT-based media. To overcome this, educational institutions need to offer professional development programs that equip teachers with the skills necessary to adapt to evolving educational technologies.

In addition to the challenges faced by educators, students' use of technology also requires careful guidance. While many students are adept at using ICT for entertainment or social interaction, they may lack the discipline to apply these tools productively for educational purposes. Hence, the study calls attention to the role of educators in guiding students to use technology responsibly, ensuring that it enhances their academic progress rather than becoming a distraction.

The research undertaken in this study not only examines the effectiveness of ICT-based learning but also seeks to provide practical recommendations for the Indonesian educational system. As the country continues to embrace digitization, the insights gathered from comparing ICT and traditional methods could inform future policies and strategies for educational improvement. Ultimately, this study aims to contribute to Indonesia's broader efforts to enhance educational outcomes by promoting the integration of technology, preparing students for a world increasingly driven by digital innovation.

By addressing these research objectives, the study offers valuable insights into the role ICT can play in improving educational outcomes. It reinforces the idea that while technology has immense potential to transform education, success hinges on comprehensive infrastructure, ongoing educator training, and effective student engagement. The findings from IAKN Tarutung could help guide Indonesia in developing a more ICT-inclusive education system that equips future generations with the skills needed for the digital era.

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