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THE ROLE OF ICT IN CREATING INTERACTIVE LEARNING AND FOSTERING STUDENT CREATIVITY: A LITERATURE REVIEW

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ABSTRACT

The use of interactive learning media has emerged as an innovative solution to enhance the quality of education, particularly in the digital era. Educational institutions need to optimize the use of learning media. This study aims to explore the functions and roles of Information and Communication Technology (ICT) in creating interactive learning environments, fostering student creativity, and improving teachers' knowledge of technology utilization. The research was conducted using a literature review method, which involves analyzing and synthesizing information from various carefully selected sources through several stages: (a) formulating the initial question, (b) conducting a scoping search, (c) mapping the literature, and (d) identifying keyword criteria. The findings indicate that interactive learning media can improve material comprehension, learning motivation, and active student engagement in the learning process. Through the integration of technology, such as projectors and educational videos, students can learn in a more dynamic and engaging manner, thereby developing their social skills and critical thinking abilities. The implementation of ICT is highly influenced by teachers' capabilities in understanding technological knowledge, pedagogy, and content mastery. The main challenges include limited technological infrastructure and insufficient teacher competency, while supporting factors encompass the provision of hardware, regular training, and school policies that encourage ICT utilization.
Keywords: ICT, Creativity, Interactive, Teacher Competency

INTRODUCTION

Education serves as a fundamental pillar in equipping children with essential competencies for their future lives. As a universal concern confronting all societies and nations, educational systems are significantly influenced by multiple factors including available infrastructure, cultural contexts, and socioeconomic conditions. Within contemporary educational practice, observable disparities in technological infrastructure frequently emerge as a primary challenge. This study aims to critically examine technology's specific role in enhancing instructional implementation within school environments. Such examination is particularly crucial to ensure educational processes effectively leverage digital technologies in this modern era. This is especially evident when comparing developed countries to those still in the process of development (Yudin Citriadin, 2019).

The use of technology in education has significantly transformed how people interact and learn in classrooms. Technology offers new opportunities to enhance learning efficiency, facilitate access to diverse educational resources, and build skills relevant to the digital era (Tekege, 2017). It enables the use of various digital tools and platforms in educational settings, including computers, the internet, mobile devices, educational software, and interactive learning applications. These tools can increase student engagement, support personalized learning, and help students develop skills needed in an increasingly complex and dynamic workplace (Sutopo, 2023). In this context, the researcher aims to further investigate the implementation of educational technology, examining both infrastructure adequacy and teacher readiness, to enhance instructional effectiveness. This study seeks to identify how optimal integration of technological resources can be achieved to maximize learning outcomes.

Global demands require the education sector to continuously adapt to technological developments to improve quality, particularly in the use of learning technology (Anih, 2016). Information and Communication Technology (ICT), as part of science and technology, is a technology related to data collection and processing. In education, ICT plays many roles. Information technology has seemingly replaced conventional books, teachers, and teaching methods (Siti and Nurizzati, 2018). Technological proficiency serves as a fundamental prerequisite for the effective development of ICT-based learning.

Access to information and learning resources has become easier thanks to technology in education. Students now have access to e-books, peer-reviewed journals, instructional

videos, and other online learning materials. This promotes lifelong learning, broadens students' knowledge, and enhances their engagement. Technology also encourages more dynamic and team-based learning styles. Students can participate in online discussions, collaborate with peers on virtual projects, and share ideas electronically through online learning platforms. These opportunities allow students to learn actively, think critically, and collaborate, fostering social skills essential for daily life (Simanjuntak, 2019).By creating engaging and enjoyable learning environments, technology can enrich students' educational experiences. For example, simulations, educational games, and interactive multimedia can boost students' enthusiasm and interest in learning new things. As a result, students learn in a more natural and enjoyable way, making education more motivating and appealing (Iskandar et al., 2023). Despite its many benefits, technology must be used in education cautiously and not excessively. It is essential to consider aspects such as technological accessibility, adequate teacher preparation, data security, and the implications of technology use in education (Zakaria et al., 2023).

The use of ICT in education has a long history. Initiatives such as educational radio and television broadcasts were early efforts to disseminate information across educational institutions in Indonesia, demonstrating the potential of ICT to support community education. However, a major drawback of radio and television broadcasts is the lack of immediate interaction between teachers and learners (Kusmayadi, 2015). Some applications of ICT in learning include presentations, internet-based information access, and virtual classrooms.Technology also enables individualized and adaptive learning. With the help of smart learning tools, students can learn at their own pace and in ways that suit them best (Kom, 2021). Technology allows learning materials to be tailored to students' needs and comprehension levels, maximizing their learning potential.

Additionally, technology offers a variety of engaging and interactive tools and resources to enhance student engagement. Through multimedia, simulations, educational games, and online platforms, students can enjoy enriching and enjoyable learning experiences that boost their motivation and understanding. Technology also provides access to diverse educational resources, such as scientific publications, online databases, and instructional videos, helping students expand their knowledge.

Technology not only benefits students but also enhances teachers' roles in the educational process. Using technological tools and platforms, teachers can organize courses effectively, create engaging and interactive learning materials, and provide timely feedback to students (Nurhasanah, Pribadi, and Ismawati, 2022). Technology also

facilitates communication and collaboration among teachers, students, and parents, fostering a connected and supportive learning ecosystem.

It is important to remember that technology is merely a tool, and the human role remains central in education (Muliastrini, 2020). Teachers remain the cornerstone in guiding, inspiring, and directing students in the learning process. Therefore, the integration of technology in education must be done wisely and balanced, considering students' needs, available resources, and the educational context.In the digital era, it is crucial for all stakeholders in education—teachers, students, parents, and institutions—to work together to leverage technology as a tool for innovative and high-quality learning (Santika, 2021). Thus, the introduction of technology in education not only offers short-term benefits but also has the potential to transform the educational landscape, preparing younger generations for future challenges and creating a knowledgeable and competitive society.

The effectiveness of ICT in learning can be measured through student engagement during the teaching and learning process. Annisa et al. (2019) show that interactive multimedia aligns with current trends and students' environments, where students are highly familiar with digital devices and more attracted to technology. Interactive media help students understand concepts in engaging ways, while collaborative platforms enable discussions and cooperation among students through online forums or video conferences. Additionally, automated evaluation systems provide real-time feedback, helping students better understand their learning outcomes. The integration of ICT in education holds great potential to enhance learning quality through technological relevance, student engagement, and personalized learning. However, its successful implementation depends on factors such as adequate infrastructure, teachers' mastery of TPACK, and school policies that support sustainable technology use (Tri Worosetyaningsih, 2023). Thus, ICT not only improves education quality but also prepares students for the challenges of the digital era, in line with UNESCO's recommendations on sustainable education.

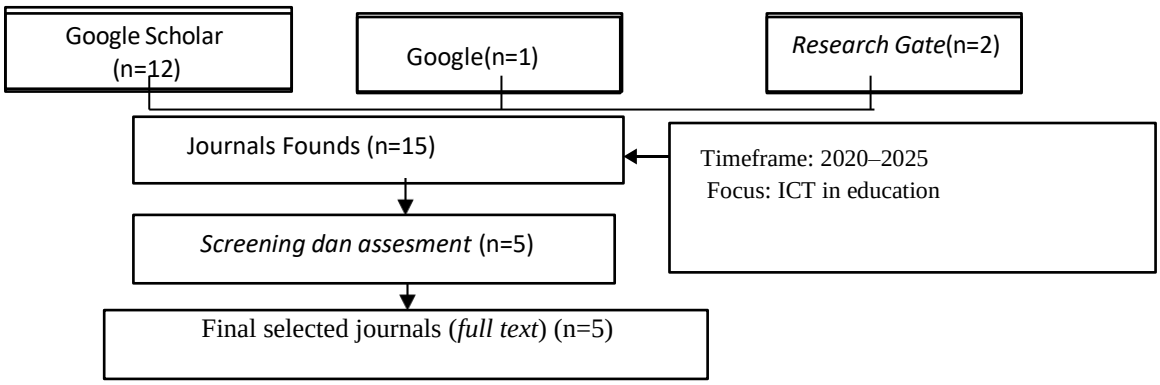
This study systematically investigates ICT's dual role in (1) enabling interactive learning systems and (2) enhancing student creative capacities through a critical analysis of empirical literature. The review specifically maps both facilitating conditions (digital infrastructure, teacher training) and implementation barriers (technological access disparities, curriculum integration challenges) while highlighting under-researched areas in contemporary educational technology discourse.

RESEARCH METHOD

This research employs a literature review method, drawing from various sources and scholarly reviews to provide an in-depth description of ICT implementation in secondary schools. Case studies allow for a comprehensive understanding of contemporary phenomena in real-life contexts (Yin, 2018). The research focuses on evaluating ICT implementation based on effectiveness, students' and teachers' technological proficiency, and its impact on the teaching and learning process. Data is collected and analyzed through comparisons, leading to conclusions supported by strong evidence.

This study uses a literature review method with references sourced from journals. The journal selection process involves the following steps:

Figure 1. Journal search process Prisma Flow diagram



Based on searches in Google Scholar, ResearchGate, and Google using keywords like Technology, Information, Communication, Creativity, and Interactive, the researcher identified four selected journals that were complete and accessible for discussion. These journals, published between 2020 and 2025, serve as references for the findings and analysis.

FINDINGS AND DISCUSSION

Table 1. Findings from selected journals

No	Author(s)	Title	Findings
1	Junika Indar Sawitri et al.	Improving Learning Quality Using Interactive Learning Media	The study shows that interactive learning media enhance students' understanding of material,

No	Author(s)	Title	Findings
			motivation, and active participation in learning. Technology integration, such as projectors and educational videos, enables dynamic and engaging learning. Interactive learning also develops social skills and critical thinking. Challenges include limited technological infrastructure, requiring additional support for optimization.
2	Fitria Nurul Aulia et al.	Utilizing Creative Technology and Learning Media to Enhance Motivation and Academic Achievement in Elementary Schools	Analysis shows that technology-based learning media significantly influence students' desire to learn and their academic success in elementary schools.
3	Siti Aisyah et al.	Utilizing Digital Technology as Interactive Learning Media for Elementary Students	The literature review concludes that digital technology helps students easily increase their interest and learning outcomes, creating an interactive learning environment.
4	Iki Wahyudi et	The Role of ICT in Digital	Findings indicate that ICT has

No	Author(s)	Title	Findings
	al.	Class Programs: A Study of Functions, Barriers, and Supporting Factors	five main functions: learning resource, collaboration, personalization, engagement, and assessment. Successful implementation depends on teachers' TPACK, technological infrastructure, and supportive school policies. Challenges include limited infrastructure and teacher competency.

The literature review reveals a consensus on ICT's ability to enhance learning. However, several supporting factors within the educational environment determine its effectiveness in schools. The use of technology is not limited to hardware and software; it also enables distance learning (online), project-based learning, and virtual collaborative learning. Technologies such as virtual reality (VR), augmented reality (AR), and other digital tools facilitate more effective, engaging, and inclusive learning experiences. Meanwhile, creative learning media goes beyond mere teaching aids—it is designed to stimulate students' curiosity and imagination. According to Junika Indar Sawitri et al. in their journal *"Improving Learning Quality Using Interactive Learning Media"*, interactive learning media enhances students' understanding of material, motivation, and engagement in the learning process. Here, "engagement" refers to student creativity, where "creative" means using media in innovative and engaging ways, such as:

a) Interactive learning videos
b) Gamification apps
c) Multimedia tools combining text, images, audio, and video

These media aim to make learning more dynamic, encourage active participation, and support different learning styles (visual, auditory, kinesthetic). Creative learning

media also aligns with technological advancements, as students today are more accustomed to digital tools. It helps present complex or abstract concepts in a simpler, more engaging, and challenging manner, thereby improving motivation and academic performance. For example: Animated videos explaining scientific processes Interactive simulations for mathematical concepts Interactive learning media significantly boosts student engagement in the classroom. Activities such as interactive quizzes, educational games, and technology-based projects encourage deeper participation and make learning more enjoyable and motivating.

The Role of Motivation in Learning

Motivation is defined as a mental drive that directs, activates, channels, and sustains human actions, including learning (Rusmiati et al., 2021). Several strategies can enhance student motivation:

1. Academic success
2. Believing that high grades matter
3. Feeling satisfied while learning
4. Adopting efficient learning strategies
5. Understanding one's position in class

According to Nur'aini et al. (2024), the following theories support innovative learning methods that enhance motivation Constructivism Theory Encourages active student participation in constructing knowledge, fostering deeper understanding. Maslow's Hierarchy of Needs is A learning environment that addresses psychological needs (e.g., safety, belonging, esteem) enhances motivation. Flow Theory (Csikszentmihalyi) Challenging yet achievable tasks create an immersive "flow" experience, increasing engagement. Social Cognitive Theory (Bandura) Social interaction and observational learning (e.g., peer collaboration via digital platforms) strengthen motivation. Self-Determination Theory (Deci & Ryan) Giving students autonomy (e.g., self-paced digital learning) boosts intrinsic motivation. Fitria Nurul Aulia et al.'s research supports these theories, concluding that innovative learning methods—tailored to students' psychological and social needs—enhance engagement and willingness to learn.

In reseacrh identified five key functional domains of ICT implementation in education. First, as digital learning resources, ICT provided e-books, instructional videos, and educational apps, teachers reporting significant improvement in students' comprehension of complex topics through multimedia aids. Second, ICT facilitated collaborative learning through platforms like Google Classroom and Zoom, where of students demonstrated greater participation in digital discussions compared to traditional face-to-face interactions. Third, personalized learning was enabled through adaptive applications (e.g., Quizlet, Duolingo), which of students found more effective than standardized pacing. Fourth, engagement metrics revealed that interactive tools including VR and gamification increased student involvement, with reporting higher motivation than conventional methods. Finally, assessment efficiency was enhanced through digital platforms like Google Forms, students achieved better understanding of evaluation criteria through immediate, automated feedback. These findings collectively demonstrate ICT's transformative capacity across pedagogical dimensions when properly implemented in religious education contexts.

According to Armiyati & Fachrurozi (2022), teachers' TPACK (Technological Pedagogical Content Knowledge) competency is not limited to technology-related or exact science subjects. The study revealed that the lowest scores were in the Technological Content Knowledge (TCK) component, with 13% of respondents expressing uncertainty. This indicates that prospective teachers' ability to integrate learning content into technological tools still needs improvement. Without adequate infrastructure, teachers face difficulties in effectively implementing technology in their instruction. Another study by Dewi et al. (2019) highlights infrastructure limitations as a major challenge. Many schools, especially in remote or under-resourced areas, lack sufficient access to technological devices and stable internet connectivity. Additionally, teachers' digital competency remains a significant barrier. Many educators lack the necessary knowledge and skills to integrate technology into teaching. Valtonen et al. (2019) emphasize the importance of Pedagogical Knowledge (PK) and Technological Pedagogical Knowledge (TPK) within the TPACK framework to help teachers create effective learning experiences. Riani's (2023) research further notes that limited training in information technology utilization contributes to teachers' low proficiency in using digital media. However, contrasting Valtonen et al.'s findings, Ahmad's (2019) study demonstrates that even with minimal training, the use of ICT in

Islamic Studies positively impacts students' understanding of religious concepts. This discrepancy suggests that while teacher competency is crucial, other factors—such as student motivation and administrative support—also play a significant role. Supporting and Hindering Factors in ICT Implementation

Supporting Factors

1. Teacher Competency (TPACK) – Training in technology-integrated pedagogy is crucial.
2. Adequate Infrastructure – Reliable devices (e.g., iPads) and stable internet.
3. Technology-Based Lesson Plans (RPP) – Structured integration of ICT in curricula.
4. Digital Assessment Platforms – Tools like Google Classroom streamline grading.
5. Parental Support – Ensures access to devices at home.
6. Technical Support Team – Resolves tech issues promptly.

Barriers

1. Poor Infrastructure – Slow internet (100 Mbps bandwidth), insufficient devices.
2. Teachers' Low Tech Skills – Requires intensive training.
3. Rigid Curriculum – Not designed for digital integration.
4. High Initial Costs – Expenses for devices/apps.
5. Resistance to Change – Fear of technology's negative impact.
6. Lack of Quality Content – Few standard-aligned digital resources.

This analysis identifies critical supporting factors and barriers influencing successful ICT integration in education. Key enablers include strong teacher competency in TPACK (Technological Pedagogical Content Knowledge), adequate technological infrastructure, structured digital lesson plans, efficient assessment platforms, parental involvement, and dedicated technical support. These elements collectively create an ecosystem conducive to technology-enhanced learning.

Conversely, significant challenges persist, particularly poor infrastructure (slow internet speeds, insufficient devices), inadequate teacher digital skills, rigid curricula resistant to technological adaptation, high implementation costs, resistance to change among stakeholders, and a scarcity of quality digital content aligned with learning standards.

CONCLUSION

This study systematically examines the role of Information and Communication Technology (ICT) in enhancing interactive learning and fostering student creativity through a comprehensive literature review. The findings highlight ICT's multifaceted benefits, including improved comprehension, motivation, and engagement through digital resources, collaborative platforms, personalized learning tools, and automated assessment systems. However, the successful integration of ICT in education depends on several critical factors: adequate technological infrastructure, teacher competency in Technological Pedagogical Content Knowledge (TPACK), and supportive institutional policies.

Despite its transformative potential, significant challenges persist, particularly in under-resourced settings. Infrastructure limitations, insufficient teacher training, and rigid curricula hinder optimal ICT implementation. The research underscores the necessity of addressing these barriers through targeted interventions, such as enhanced professional development for educators, investment in digital infrastructure, and curriculum adaptations that align with technological advancements. Furthermore, the study identifies gaps in current research, including the need for longitudinal studies on ICT's sustained impact, standardized frameworks for assessing digital learning outcomes, and greater representation of diverse educational contexts—particularly rural and developing regions. Future research should explore cost-effective ICT models, innovative pedagogical strategies, and policy measures that ensure equitable access to technology-enhanced learning.

In conclusion, while ICT presents a powerful tool for modernizing education, its effectiveness hinges on a balanced approach that combines technological integration with pedagogical expertise and institutional support. By addressing existing challenges and leveraging ICT's full potential, educational stakeholders can create dynamic, inclusive, and future-ready learning environments that prepare students for the demands of the digital age.

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