

Implementation of ICT-Based Problem-Based Learning Model to Improve Higher Order Thinking Skills in IPAS Learning in Madrasah Ibtidaiyah

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Abstrak:

Transformation in the education system is needed to meet the needs of the 21st century, which emphasizes critical, creative, and collaborative thinking skills. This study aims to explore the implementation of the Problem-Based Learning (PBL) model based on Information and Communication Technology (ICT) in improving higher-order thinking Skills (HOTS) in learning Natural and Social Sciences (IPA) in West Lombok Madrasah Ibtidaiyah. This research used a descriptive qualitative method, with data collected through interviews, observations, documentation, and HOTS written tests. Data analysis used the theory of Miles and Huberman data reduction, condensation, data display and conclusion drawing. Students involved in this method are more motivated and active in learning, especially with ICT tools such as Quizizz and computer simulations that make it easier to understand learning concepts. The implementation of ICT-based PBL not only improves students' higher-order thinking skills but also makes learning more exciting and contextualized. Despite challenges such as limited technological infrastructure, this approach has significantly impacted learning in Madrasah Ibtidaiyah.

Kata Kunci:

ICT; Higher Order Thinking Skills; Problem-Based Learning; IPAS

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Introduction

The transformation of the education system to meet the demands of the 21st century involves a shift from traditional knowledge transfer to the development of critical thinking and application skills. This evolution emphasizes the importance of understanding the process behind critical thinking rather than just the outcome ([Karakaya & Öc, 2024](#)). In this case, higher-order thinking Skills (HOTS) become the main focus in improving the quality of learning, especially in schools that teach Natural and Social Science "Ilmu Pengetahuan Alam dan Sosial" (IPAS) subjects. One method that is very effective in honing these skills is the Problem-Based Learning (PBL) model, especially when integrated with Information and Communication Technology (ICT). Integrating ICT into PBL provides opportunities for students to be more active in exploring and solving real-world problems innovatively ([Ranggana et al., 2024](#)). By utilizing ICT, educators can create a dynamic learning environment that supports the development of critical thinking, creativity, and communication skills, which are essential for navigating the complexities of the modern world ([Todorova, 2024](#)).

PBL is an innovative educational approach that places students at the centre of the learning process, promoting autonomy, critical thinking, creativity, and collaboration. It is highly effective in developing cognitive, socio-emotional, and technological skills necessary for academic and professional success ([da Silva et al., 2019](#)). PBL has been shown to improve HOTS by engaging students in real-world problem-solving ([Selirowangi et al., 2024](#)). ICT provides a competitive advantage by improving services for students and teachers, increasing productivity, and creating a more engaging learning environment ([Tavares et al., 2024](#)).

At Madrasah Ibtidaiyah Intisyarul Ulum West Lombok, an ICT-based PBL model has been implemented to help science class students understand the subject matter more deeply. Students are given real problem-based projects, such as the environmental issue of "not littering." Through this approach, students are invited to understand environmental concepts and find innovative solutions to the problem with the help of technology such as computers, projectors, tablets, and the Internet. ICT tools allow students to search for information independently, analyze data, and present solutions more effectively ([Arifin et al., 2021](#); [Arif et al., 2023](#)). ICT encourages critical and creative thinking, developing HOTS skills ([Adeliana et al., 2021](#); [Arif et al., 2023](#)).

ICT-based learning makes students feel more enthusiastic and motivated because technology makes accessing information more accessible and enriches their understanding of the material. ICT-based PBL allows students to develop analysis and evaluation skills and improves their ability to create and collaborate ([Adeliana et al., 2021](#); [Sari & Memonah, 2024](#)). In the learning process, students are invited not just to be passive recipients of information but to become active learners who can design innovative solutions to problems.

However, implementing ICT-based PBL at Madrasah Ibtidaiyah Intisyarul Ulum West Lombok is challenging. One of the main obstacles faced is the limited technological infrastructure, such as the need for access to devices and adequate internet networks. In addition, teachers' readiness to integrate technology into teaching methods is also a significant challenge. Many teachers are not accustomed to using ICT optimally in the learning process, so intensive and continuous training is needed ([Sholeh et al., 2021](#)).

To overcome this challenge, the school, especially the head of Madrasah Ibtidaiyah Intisyarul Ulum, has tried to improve the quality of education through several initiatives. One of the steps taken is to conduct regular training so that teachers are better equipped to adopt technology in learning. In addition, the school also collaborates with the government to improve the technology facilities available

at the school, such as expanding internet access and providing adequate devices for students and teachers. With these efforts, the school hopes to make students and teachers as agents of change who can improve the overall quality of learning.

In addition, previous research has shown that applying ICT-based PBL in science learning improves students' critical thinking skills and helps teachers develop more exciting and effective learning strategies ([Adeliana et al., 2021](#); [Jang, 2023](#)). Real problem-based projects allow students to memorize concepts and analyze and evaluate information independently. This learning process is critical in shaping students who are independent, creative, and ready to face the challenges of the future world ([Mauilyda et al., 2020](#); [Wulandari et al., 2023](#)).

The Indonesian government has also recognized the importance of HOTS development in the education curriculum, especially in subjects such as IPAS, mathematics, and literacy. Educational programs focusing on improving HOTS in primary and secondary schools continue to be encouraged, hoping to create a generation that can compete globally ([Ananda et al., 2020](#); [Zainal, 2022](#)). Therefore, this research is expected to make a real contribution to supporting these goals by offering an ICT-based PBL learning model that can be implemented more widely in schools in Indonesia.

Through the design and implementation of ICT-based PBL, teachers are expected to continue to nurture students' curiosity, direct them to think critically, and motivate them to find innovative solutions to their problems. It is one of the strategic steps in building students' higher-order thinking skills and improving Indonesia's education quality.

Research Methods

This research uses a descriptive qualitative method to analyze the effectiveness of the application of the Problem-Based Learning (PBL) model based on Information and Communication Technology (ICT) in developing higher-order thinking Skills (HOTS) in Science subjects at Madrasah Ibtidaiyah Intisyarul Ulum West Lombok. Descriptive qualitative research was chosen because this method allows in-depth data collection related to social phenomena and participants' experiences in the context of learning. This research not only aims to describe the process of implementing ICT-based PBL but also explores how this method affects students' motivation, engagement and critical thinking skills.

This research was conducted at Madrasah Ibtidaiyah Intisyarul Ulum in West Lombok, West Nusa Tenggara. This location was chosen because this school has integrated ICT into science learning through the PBL model, although with limited infrastructure. The research subjects consisted of grade 5 students totalling fifteen students, Science subject teachers who became facilitators in the application of ICT-based PBL and the school principal who provided insight into school policies, infrastructure constraints, and efforts to improve technology facilities to support ICT-based learning.

This research uses several collection techniques, including interviews, observations, documentation, and HOTS written tests. Data analysis used the theory of ([Miles et al., 2014](#)) data reduction, condensation, data display and conclusion drawing. This study used method triangulation to ensure data validity and reliability, which compares data obtained from interviews, observations, and documentation. In addition, member checking was conducted by confirming the interview results to the respondents to avoid misinterpretation. The use of the HOTS test as an additional instrument also helped strengthen the validity of the research results, as the

qualitative data was supported by quantitative evidence of the increase in students' test scores.

Results and Discussion

Students' Response to ICT-based PBL in Improving Collaborative Skills

Problem-based Learning (PBL) in higher-order thinking skills (HOTS) encourages students to think more than just memorization. HOTS-based PBL helps teachers analyze students' experiences and stimulate enjoyable, higher-order learning. The main goal is to develop students' character, creativity, skills and interests ([Widyaningrum, 2023](#)). According to [Hadi, \(2014\)](#), critical thinking is a convergent mindset that processes information to produce conclusions, while creative thinking is a divergent mindset that develops ideas from information ([Chasanah & Prastowo, 2021](#)). Science teaches critical and creative thinking ([Anugrah & Mu'alim, 2022](#)). Science learning with HOTS improves critical thinking skills in observing and analyzing natural phenomena and teaches complex problem-solving through experimentation and investigation ([Zulfa et al., 2023](#)). In addition, science involves discussions, presentations, and report writing that hone argumentation skills ([Novianti et al., 2020](#)). Science learning broadens students' horizons about the natural world, encourages creative thinking, and develops critical thinking attitudes essential for addressing today's world's challenges ([Yusuf et al., 2020](#)). Thus, science is a strong foundation for developing HOTS, helping students master scientific concepts while developing higher-order thinking skills ([Mahanal, 2019](#)).

Learning Based Learning is a learning approach in which students learn material through solving concrete problems ([Sulisworo et al., 2021](#)). This approach emphasizes the active involvement of students in understanding concepts and their application in real-life situations ([M. Sari & Rosidah, 2023](#)). Learning Learning in the journal ([Ortega-Sánchez & Jiménez-Eguizábal, 2019](#)) is a teaching methodology that supports students to be taught through collaborative and individual projects. Information and Communication Technology (ICT) in education has changed how students learn and teachers teach. Technological tools not only make learning more efficient and engaging but also allow access to a variety of resources and learning methods that were previously unavailable ([Lv et al., 2024](#)).

Most Intisyarul Ulum madrasah ibtidaiyah students responded positively to problem-based learning (PBL) and Information and Communication Technology (ICT). With ICT-based PBL learning, 85% of students feel more motivated and interested in learning. These two learning methods are more dynamic and exciting, making students more eager to follow science lessons. On the other hand, visualization and interactive simulation can quickly help students understand learning for example, multimedia, video, and computer simulation. In addition, the teacher also revealed that the practice used in learning-based learning at West Lombok ibtidaiyah madrasah in class V science subjects applies the Quizizz application, which can be used as a tool to introduce additional material or to deepen students' understanding of specific topics relevant to the project. Students can learn from their mistakes through the answer explanations provided after taking the quiz, which supports problem-solving-based learning. In addition to the benefits of Quizizz, it is also beneficial for Teachers to create quizzes that lead to critical concepts that they want to emphasize in the project; sequential learning ensures students can understand the context of the material more effectively. It can help make learning more exciting and dynamic.

For example, a teacher uses a contextual approach in PBL to real situations relevant to students' daily lives. This approach can challenge students in finding solutions in the learning process ([Ayerbe-López & Perales-Palacios, 2023](#)). Not only that, but to maintain students' enthusiasm, teachers usually give group assignments

to encourage students to work together in groups, discuss, and share ideas with their peers ([Isnaeni et al., 2021](#)). Therefore, this collaboration increases student understanding and makes learning more fun and exciting ([Polo-Rojas et al., 2023](#)). The example given by the resource person in implementing PBL and ICT in science learning is that students are told to protect the environment. For example, students are asked to research the causes and effects of problems using online information sources; then they present the solutions they find ([Medina et al., 2022](#)). Digital tools commonly used by students include computers, tablets, projectors, and internet access ([Shpeizer, 2019](#)). In addition, online learning platforms such as Via WhatsApp and science simulation applications are also often used to support the teaching and learning process ([da Silva et al., 2019](#)). Students' response to the use of ICT in science learning in madrasah Ibtidaiyah is very enthusiastic; they feel more interested and motivated to learn ([Tania et al., 2020](#)). Learning using ICT helps them more easily access information and enrich their understanding of the material being studied ([Radeswandri et al., 2019](#)).

Thus, to solve these problems, students can also use computer simulations to visualize environmental changes ([Gumisirizah et al., 2024](#)). One of them is not littering. The presence of math and ICT-based learning methods in the learning process can increase student involvement ([Pedrosa, 2024](#)). It can make it easier for students to understand concepts better. Not only that, students are more active in digging up information, discussing, and solving problems ([Benlaghrissi & Ouahidi, 2024](#)). The results achieved in learning after applying this ICT-based PBL model are very significant; students show increased critical thinking ability, creativity, and collaborative skills ([Valiente et al., 2019](#)). Students' academic scores are also improved, and they more actively participate in class discussions ([Arranz-garcía et al., 2019](#)). In addition, they are more eager to face real-world challenges because they are used to solving problems using a structured and technology-based approach ([Sanchez et al., 2019](#)).

Improving Students' Ability in Science Learning by Using HOTS and ICT

Higher Order Thinking Skills (HOTS) is the ability to think higher than just memorizing or retelling information ([Wibawa & Agustina, 2019](#)). West Lombok madrasah ibtidaiyah teachers stated that HOTS trains students to analyze, evaluate, and create something creatively from the facts learned. According to [Aminah & Rohayati \(2021\)](#), students' abilities in learning can be improved by combining HOTS and Information and Communication Technology (ICT). Using the Internet to collect data and analyze information, as well as digital presentations, discussion forums, problem-solving games, and multimedia, can improve HOTS skills and make learning more immersive and exciting ([Acesta, 2020](#)).

In the science lesson at Madrasah Ibtidaiyah Lombok Barat, students are asked to find information about ecosystems from the Internet, analyze it, make a digital presentation, and present it in class. Teachers also use online discussion forums such as Quizizz and educational games to make them more interested and active. Students' response to the HOTS (Higher Order Thinking Skills) based learning method is very positive. They feel challenged and more energized because it uses the technology they love. This method improves their participation, comprehension, critical thinking, and presentation skills. However, the principal of Madrasah Ibtidaiyah West Lombok revealed that the biggest challenge is the availability of technology facilities, as not all students have the same access at home. In addition, preparing HOTS and ICT-based materials requires extra time and effort. Nevertheless, the results obtained are worth the effort.

Madrasah Ibtidaiyah students can use the Internet to collect and analyze their assignments and present them digitally ([Anwar et al., 2024](#)). With guidance, they can

search for reliable sources, gather relevant information, and use simple analysis methods (Sukirman & Linse, 2024). The results are organized in digital presentations using tools such as PowerPoint or Google Slides so that they can be shared with teachers and friends in an engaging and easy-to-understand manner (Malalina et al., 2024). Using discussion forums and video conferencing tools can challenge students' critical thinking (Hao et al., 2024). In online forums, students can ask questions, provide responses, and have in-depth discussions on various topics, encouraging analytical and critical thinking (Ramírez-Montoya et al., 2024). Tools such as Zoom or Google Meet enable virtual face-to-face discussions, where students can debate, exchange ideas and develop real-life communication skills. These interactions enrich understanding of the material, practice constructing logical arguments, listening to other perspectives, and responding constructively and informatively (Liline et al., 2024).

Games designed to solve problems or simulations can improve Higher-Order Thinking Skills (HOTS) in a fun way (Hardiansyah et al., 2024). Students are faced with complex challenges that require the application of knowledge, evaluation of situations, and strategic decision-making. This process hones critical, creative, and analytical thinking skills in an interactive and engaging context (T'Sas & Daems, 2024). In addition, game elements provide additional motivation through achievements and rewards, making learning more engaging and effective (Rusli et al., 2024). Utilizing multimedia such as videos, animations, and infographics can convey complex concepts more comprehensibly and engagingly (Mazibuko & Maharaj, 2024). Videos and animations visually depict complex processes, while infographics graphically present data and relationships between concepts (Kurniawan et al., 2024). Multimedia can clarify the material, encourage students to think critically and improve their understanding and analytical skills (Dawana et al., 2024).



Figure 1: Implementation of ICT-Based Problem-Based Learning Model to Improve HOTS

Conclusion

Research and practice related to problem-based learning (PBL) by integrating Information and Communication Technology (ICT) in education, especially in West Lombok Madrasah Ibtidaiyah, shows that this approach effectively improves students' collaborative skills. Problem-based learning supported by ICT motivates students to be more active and interested in learning. Visualization and interactive simulations make it easier for them to understand the material. Using applications like Quizizz deepens students' understanding of relevant topics and supports problem-solving-based learning. The contextual approach in PBL connects the

subject matter to real-world situations and encourages students to seek solutions collaboratively, increasing their engagement and understanding. In addition, integrating HOTS (higher-order thinking Skills) in science learning through ICT facilitates the development of critical, creative and analytical thinking skills. Although challenges such as the availability of technology facilities still exist, the benefits gained from this approach are significant, including improved thinking ability, collaborative skills and active participation of students in the classroom. Thus, the ICT and HOTS-based PBL learning model in West Lombok Madrasah Ibtidaiyah succeeded in creating an interactive, engaging, and effective learning environment that prepares students to face challenges in the real world.

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