

A COMPARISON OF INDONESIA AND MALAYSIA'S NATIONAL EDUCATION SYSTEM IN TERMS OF SCIENCE LEARNING IMPLEMENTATION

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Abstract: Focusing on curriculum, teaching methods and learning outcomes, this study compares the policies and implementation of science learning in Indonesia and Malaysia. This research stems from the fact that science education is crucial to building quality human resources in the era of globalization. One of the main problems faced is the difference in policy and the effectiveness of the implementation of science education in the two countries. The purpose of this study is to look at the differences in the science education system in the two countries, find the problems faced, and make suggestions to improve the quality of science learning in Indonesia. A literature study was conducted using a descriptive-comparative approach. The results showed that Malaysia has a more stable science education system after STEM integration. On the other hand, Indonesia is transitioning to the Merdeka Curriculum, and there are problems in implementing it. Indonesia still uses the lecture method, but Malaysia uses project and technology-based approaches. The science literacy of Indonesian students is lower compared to Malaysia, according to the results of PISA and TIMSS evaluations. So, to improve science literacy and global competitiveness, policy stability, improved teacher training, and implementation of project- and technology-based learning are needed to improve science education in Indonesia.

Keywords: Science Education, Education System, Implementation, Learning, Science Curriculum

INTRODUCTION

Science education has a very significant role in building quality human resources (HR). In this context, the importance of science education is not only seen in the development of scientific knowledge, but also in producing individuals who are able to adapt to global challenges and changes in the digital era. Science education serves as a foundation to prepare future generations who are innovative and competitive in an increasingly complex work environment (Verawati & Sarjan, 2023). One of the key aspects in science education is the ability to develop critical thinking skills and problem-solving abilities among students. Active learning approaches, such as problem-based learning models, have been shown to be effective in improving these skills, especially in the secondary education domain (Astiana Al Azizah & An Nuril Maulida Fauziah, 2023). By improving these skills, individuals are able to find effective and efficient solutions to the problems they face, thereby making a positive contribution to society and the local economy (Aisyah et al., 2024).

The differences in science learning policies and implementation between Indonesia and Malaysia are important issues that impact on the quality of education in both countries. Research shows that there are significant differences in the educational policy framework and pedagogical approaches applied in science teaching in each country. In Malaysia, the science education policy prioritizes the STEM (Science, Technology, Engineering, Mathematics) approach integrated in the curriculum. This is

aimed at preparing students with the 21st century skills required in the ever-evolving job market (Rochim, 2024). The curriculum in Malaysia favors project-based learning and experimentation, which allows students to gain a deeper understanding of science concepts through hands-on practice. The use of learning models such as Problem Based Learning (PBL) and collaborative approaches are strengthened in an effort to improve students' science literacy (Ermawati et al., 2023). On the other hand, Indonesia faces challenges in implementing science education policies. The education curriculum undergoes frequent changes, which can result in instability in science teaching (Ali Akbar et al., 2023). Despite efforts to integrate science literacy into learning, traditional teaching techniques and the use of less varied learning methods are often an obstacle. Research shows that Indonesian students' science literacy still needs to be developed, especially in improving their critical thinking skills and mastery of basic science concepts (Suparya et al., 2022).

The comparison of science learning implementation in Indonesia and Malaysia covers three main aspects, namely curriculum, teaching methods and learning outcomes. Each country has a different approach, which affects the quality of science education received by students. 1. Curriculum, Malaysia has developed an integrated STEM-based education system since the last few years. On the other hand, Indonesia is currently implementing the Merdeka Curriculum which provides excitement in the teaching and learning process. However, challenges still exist regarding the effective implementation of the curriculum in the field (Fuadi et al., 2020). 2. Teaching methods in Malaysia are generally more varied and implement active learning that involves students directly in the learning process (Fatimah, 2023). In Indonesia, although there have been some developments in more active learning, the lecture method still dominates, and many classes have not fully utilized interactive and creative approaches (Irsan, 2021). 3. Science learning outcomes in Malaysia tend to be more satisfactory when compared to Indonesia, as seen from the results of international standardized tests such as TIMSS and PISA, where Malaysian students perform better in science literacy (Fatimah, 2023). This is due to a more comprehensive and planned support system in Malaysia in planning and implementing the science curriculum. In contrast, in Indonesia, the low level of science literacy among students is an indicator that the implementation of the existing curriculum and teaching methods is not optimal. Studies show that many students do not have a good understanding of basic science concepts, which is caused by inappropriate teaching methods and teaching materials that are not contextualized (Fuadi et al., 2020).

Comparative research between the national education systems of Indonesia and Malaysia in the implementation of science learning shows significant differences even though both countries have similar social and cultural backgrounds. According to research published by Suharyanto and Hidayat (2020) and Abdullah and Ibrahim (2021) in *Media Didaktika*, the fundamental differences between the two education systems lie in the use of technology in learning, management of the science curriculum, and the pedagogical approaches applied by each country.

This study aims to analyze the differences in science learning policies and practices in Indonesia and Malaysia and identify the factors that influence the quality of science education in both countries. This study seeks to provide a comprehensive overview of how science curriculum, teaching methods and learning outcomes are interrelated in the context of preparing competitive human resources in the era of globalization and digitalization. In addition, this study also aims to formulate

recommendations for policies and learning practices that can improve students' science literacy and critical thinking skills in Indonesia, taking into account the success of approaches that have been implemented in Malaysia.

The method used in this research is a literature study with a descriptive-comparative approach. This approach was chosen as it allows for in-depth analysis of various academic sources, education policies, as well as relevant international data. Through this method, the research seeks to identify gaps and challenges in the implementation of science education in Indonesia and compare them with best practices implemented in Malaysia. Thus, the results of this study are expected to contribute to the development of more effective and sustainable science education policies in Indonesia.

LITERATURE REVIEW

Science education is a crucial component in the global education system, especially in shaping a generation that is adaptive to technological developments and 21st century challenges. A number of studies emphasize the importance of learning approaches that prioritize critical thinking skills, problem solving, and technology integration in the learning process (Damayanti & Nuzuli, 2023). In the context of Southeast Asia, Indonesia and Malaysia show different approaches in developing science education systems, especially in the aspects of curriculum, teaching methods, and learning outcomes.

Indonesia is currently undergoing a transition to the Merdeka Curriculum that emphasizes flexibility, project-based learning, and integration of local cultural values (Angga et al., 2022). However, repeated curriculum changes and lack of teacher training are the main challenges in its implementation (Ali Akbar et al., 2023). On the other hand, Malaysia has implemented a stable curriculum through the integration of STEM in the Secondary School Standard Curriculum (KSSM), which aims to equip students with technological skills and problem-solving abilities in real contexts (Abd Malek & Halim, 2023). In terms of teaching methods, Malaysia has shown success by incorporating project-based approaches and technology, and encouraging the development of computational thinking early on (Mohd Kusnan et al., 2020). In Indonesia, active learning approaches are being implemented but many schools still rely on traditional lecture methods (Irsan, 2021). This has an impact on students' science literacy which is still relatively low, as seen in the results of the PISA and TIMSS studies (Juniansyah et al., 2023).

International evaluations also show that Malaysia's education system is superior in preparing students for global challenges. Malaysia shows an increase in scores from year to year in the TIMSS evaluation, while Indonesia lags at the bottom (Kusharyadi et al., 2024). This difference reflects the effectiveness of education policies, teacher readiness, and the integration of technology in the learning process that is more mature in Malaysia. By comparing the two countries, it can be concluded that a systemic approach, policy consistency and continuous teacher training are key to improving the quality of science education. Project-based, collaborative learning and technology are ideal models that Indonesia can adopt by adjusting to the local context and national challenges.

RESEARCH METHODS

This research uses a descriptive-comparative literature study method. This method was chosen as the main method as it allows for systematic analysis of various academic sources, educational policies and previous research findings relating to the implementation of science learning in Indonesia and Malaysia. The purpose of this method is to find gaps and challenges in the implementation of science education in Indonesia and Malaysia.

FINDINGS AND DISCUSSION

Science Education Curriculum Comparison

Curriculum development in Indonesia has undergone significant changes. The Merdeka Curriculum Initiative changed the 2013 primary and secondary school curriculum. This method prioritizes project-based learning and interdisciplinary learning to solve learning problems after the pandemic. For example, research by Angga et al. found that there are differences between the implementation of Curriculum 2013 and Curriculum Merdeka, both of which focus on increasing students' independence and creativity at the primary level (Angga et al., 2022). In addition, Iskandar et al. emphasized that Merdeka Curriculum is a strategic step taken by the government to overcome the crisis of the education system that occurred during the pandemic and involve teachers and innovation in learning empowerment (Y. Iskandar, 2024). In Indonesia, the paradigm of science education not only pays attention to cognitive aspects, but also seeks to integrate cultural and religious values in education. This is reflected in the trend of research that examines the integration of science and religious education (Mujahidin & Martanegara, 2020).

On the other hand, the science education system in Malaysia implements a more stable policy within the framework of the Secondary School Standard Curriculum (KSSM). Environmental education is incorporated into science subjects. For example, Malek and Halim's research illustrates how environmental education—specifically on water conservation—is integrated into the curriculum through interdisciplinary strategies. It aims to increase conservation awareness and practical skills to deal with environmental issues, so that science is not only limited to theory but also practical application relevant to the local social and economic context (Abd Malek & Halim, 2023). This method reflects the nature of Malaysian science education which is heavily centered on skill building through hands-on experience and real problem solving.

When viewed synergistically, a comparison of the two countries' curricula shows that Indonesia is undergoing pedagogical transition and innovation by undertaking curriculum reforms that are responsive to the challenges of the times. On the other hand, Malaysia maintains a stable proven science education framework with an emphasis on character education and environmental awareness. The dynamics of curriculum change in Indonesia are characterized by efforts to integrate cultural and religious values with the development of science knowledge in an effort to create graduates who are both academically and morally sound (S. Iskandar et al., 2024). However, science teaching policies in Malaysia emphasize the use of contextual and practical approaches through integration across subjects to produce well-rounded learning relevant to contemporary issues, particularly in environmental education.

Table 1 Comparison of learning systems between Indonesia and Malaysia

Aspects	Indonesia	Malaysia
Curriculum	<ul style="list-style-type: none"> • Transitioning to Merdeka Curriculum. • Focus on project-based learning and cultural/religious values. • Not yet stable and still in the process of adaptation. 	<ul style="list-style-type: none"> • Using the Secondary School Standard Curriculum (KSSM). • Integration of STEM and environmental issues.
Teaching Methods	<ul style="list-style-type: none"> • Lectures are still dominant. • The application of PBL (Problem Based Learning) is still limited. • Technology adoption is starting to develop, but it is not yet evenly distributed. • Teachers have difficulty adapting. 	<ul style="list-style-type: none"> • More stable and systematic. • Active and varied, project and technology based. • Integration of computational and contextual thinking. • Teachers receive structured professional training.
Learning Outcomes (PISA & TIMSS)	<ul style="list-style-type: none"> • PISA and TIMSS rankings are low. • Students' science literacy is still weak. • Lack of development of critical thinking skills. 	<ul style="list-style-type: none"> • Higher ranking than Indonesia. • Achievement increases every year. • Learning is more relevant and contextualized.

Overall, a comparison between the two curricula shows that there are different strategies used to achieve the goals of science education. With Curriculum Merdeka, Indonesia pursues innovation and flexibility in learning methods, whereas in Malaysia, science content is combined with environmental education to emphasize practical relevance and empower students to face challenges around the world. The two approaches show that although the implementation and focus are different, both countries seek to improve science education through policy adjustments and interdisciplinary approaches that suit their national contexts.

Teaching Methods and Their Effectiveness

A comparison between teaching methods in Indonesia and Malaysia suggests an in-depth consideration of the effectiveness and relevance of the approaches implemented in each country. In this context, it is important to look at how different teaching methods are applied and how they affect student learning outcomes.

Research conducted by Azizah et al. shows that problem-based learning (PBL) can improve the science literacy of students in Indonesia, especially in the context of socio-scientific problems (Dinda Nur Azizah et al., 2021). PBL makes learning more interesting as it encourages students to think critically and relate it to real-life situations. In addition, research shows that combining traditional teaching methods with technology, such as instructional videos and educational game tools, can improve learning outcomes (Damayanti & Nuzuli, 2023). In such a situation, there needs to be a continuous effort to incorporate technology into the learning process to keep students more engaged and achieve better results.

In addition, teaching in Malaysia shows progress in computational thinking and the use of technology in education. According to research conducted by (Mohd Kusnan et al., 2020), various types of computational thinking activities are used in education in Malaysia. This is crucial to prepare students to face global challenges in today's technological era. The use of technology in learning not only makes students more engaged, but also makes learning more effective. In addition, research shows that the approach used in Malaysia often focuses on integrating the subject matter with the

needs of society. This helps students understand the application of science in the real world (Murtadlo et al., 2023).

In addition, research shows that the use of technology combined with traditional methods is also effective in teaching in Indonesia, which improves learning in primary schools (Damayanti & Nuzuli, 2023). This shows that although traditional methods are still used, the incorporation of technology can make learning more interactive, efficient and fun.

A study on the challenges teachers face when implementing Merdeka Curriculum found that teachers face difficulties adjusting to curriculum changes and new teaching techniques (Safitri & Fajar, 2023). This research emphasizes that adequate support for teachers is needed to face these challenges and ensure that educational goals are achieved. Teaching effectiveness is strongly influenced by conditions, teachers' readiness to apply new methods, and support from educational institutions (Hasanah, 2023).

In addition, research shows that education in Malaysia is more organized, with professional development and teacher training taking precedence to improve the quality of learning (Amelia et al., 2024). While in Indonesia, the independent curriculum has been updated, but training is still being adjusted and refined.

Overall, Indonesia and Malaysia have great potential to improve educational outcomes by utilizing technology and active learning methods. By incorporating approaches that are relevant to the needs of the times and increasing teacher and student engagement, it is expected that teaching methods in both countries will be more effective.

Evaluation of Learning Outcomes Based on PISA and TIMSS

Student learning results from the Program for International Student Assessment (PISA) and TIMSS (Trends in International Mathematics and Science Study) provide an excellent picture of the quality of education in Malaysia and Indonesia. The focus of these two international assessments is on students' abilities in learning, science and math. The results show a huge difference in student achievement in the two countries.

The 2018 PISA data showed that Indonesia's math skills ranked 72nd out of 77 countries, with a score of 379; this indicates that math education in Indonesia is less than satisfactory (Juniarti Iryani et al., 2023). This situation is in line with research conducted by Yusmar and Fadilah, who found that contextualized education and lack of teaching techniques contribute to low PISA results (Yusmar & Fadilah, 2023). In contrast, Malaysia ranked better than Indonesia. This suggests that the curriculum and educational methods in Malaysia are better at preparing students to face the challenges of the world (Rohaeti et al., 2020).

TIMSS 2015 results also showed the same difference; Indonesia ranked 44th out of 49 countries, indicating that Indonesian students are still below average in mathematics (Juniarti Iryani et al., 2023). In contrast, Malaysia is not only ranked above Indonesia, but also shows an increasing trend every year, which indicates the success of the education system in implementing a more effective curriculum and learning methodology (Kusharyadi et al., 2024). The research conducted by Kusharyadi et al. noted that the different methodologies and curricula implemented in the two countries contributed significantly to the improvement of the quality of education in the two countries.

In this regard, there are a number of variables that can be considered for the results of such evaluations. For example, research by Yusmar and Fadilah suggests that the education system in Indonesia does not fully concentrate on improving students' critical thinking skills and that teachers are poorly trained to use interactive and contextual learning methods as the main causes of the decline in science literacy in the country (Yusmar & Fadilah, 2023). This is contrary to the situation in Malaysia. There, educational methods that incorporate local context and technology are proven to be more effective in attracting students' interest and improving their learning outcomes (Ismiraj et al., 2024).

In addition, it is expected that Indonesian students' learning outcomes will be improved through the use of more inventive learning methods, such as the use of video-based media and project-based learning. To make Indonesia competitive with other Southeast Asian countries such as Malaysia, Khoeriah et al. recommended reforming learning strategies (Rosadi et al., 2023). This shows the courage to change education to handle world challenges.

Overall, the results of educational evaluations such as PISA and TIMSS show that there is a marked difference between Indonesian and Malaysian students in terms of their learning outcomes, especially in math and science subjects. While Malaysia has a better approach to education, Indonesia should invest more in competency-based curriculum and proper teacher training to improve science literacy.

CONCLUSION

This study compared science learning policies and implementation in Indonesia and Malaysia by focusing on curriculum, teaching techniques and learning outcomes. Malaysia has a more stable science education system due to STEM integration, while Indonesia is still in the transition stage with the Merdeka Curriculum, and there are problems implementing it. While teaching methods in Indonesia are still dominated by lectures, Malaysia uses project-based and technology approaches. Malaysian and Indonesian students have lower science literacy, according to PISA and TIMSS evaluation results. Policy stability, improved teacher training, and the use of project-based learning and technology are needed to improve science literacy and global competitiveness.

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