



An In-Depth Comparative Analysis of Science Curricula in Türkiye and Indonesia

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ABSTRACT

Government policies, including curriculum development, significantly impact education quality. Indonesia's frequent curriculum changes contrast with Türkiye's 2017 curriculum overhaul. Türkiye outperforms Indonesia in science literacy based on PISA 2018 results. The Merdeka Belajar policy aims to enhance Indonesia's global competitiveness, particularly in STEM education. Curriculum approaches differ, with Türkiye emphasizing practical learning and early physics concepts, while Indonesia relies more on rote memorization. Frequent curriculum changes in Indonesia stem from political and regional factors. This study highlights disparities in PISA scores and curriculum structures, underscoring areas for Indonesia's improvement. Adapting to international standards while considering local contexts is crucial for enhanced science literacy. The research employs a case study methodology, utilizing curriculum documents, interviews, and research articles for analysis, providing insights and recommendations for both countries. Research results indicate that Türkiye's structured curriculum and emphasis on practical learning contribute to its higher science literacy scores compared to Indonesia. In conclusion, this study underscores the need for Indonesia to align its curriculum policies with international standards, while also focusing on fostering critical thinking and practical learning approaches to enhance science literacy outcomes and remain globally competitive in education.

Keywords: Curriculum Development; Education Policies; Science Literacy; Comparative Study

INTRODUCTION

Policies are decisions established by the state to realize national goals (Clark, 2020). In the context of educational improvement, policies are crucial for enhancing a country's development (Tang, 2022). Among these policies, curriculum holds considerable influence over educational quality (Winoto, 2022). Changes in curriculum policy have a profound impact on a nation's education system (Bastian et al., 2021; Lestari, 2018; Malik, 2018; Paek & Kim, 2021). Indonesia has undergone eight curriculum changes, including pre-independence, post-independence, Curriculum Pelajaran 1947, Curriculum Pelajaran Terurai, Curriculum 1968, Curriculum 2013 (K13), K13 Refinement, and Merdeka Belajar Curriculum (Abidin et al., 2023). The Organisation for Economic Co-operation and Development (OECD, 2023) conducts global education quality surveys, resulting in the Program for International Student Assessment (PISA), which assesses science, mathematics, and literacy skills (OECD, 2019). This responds to the need for countries to improve educational quality, aligning with PISA indicators. A similar scenario is observed in Türkiye, a nation with high literacy and numeracy indices. Since 2017, President Recep Tayyip Erdoğan has initiated curriculum revitalization. The government tightly regulates education quality and controls textbooks to accelerate Türkiye's educational improvement (OECD, 2018).



Figure 1. PISA result 2018

Based on the PISA 2018 report, Türkiye scored 462.1 points, while Indonesia only scored 382.1 (OECD, 2018)(CANSIZ & CANSIZ, 2019a). This poses a challenge for Indonesia in preparing policies to improve the quality of science literacy education. The annual decline in science literacy (Ni'mah, 2019) calls for a strategic solution by the Indonesian government. Through the Merdeka Belajar policy, Indonesia aims to compete in international education challenges (Yudhawasthi & Christiani, 2022)(Fernando et al., 2022)(Sampelolo & Kombong, 2022), aspiring to be a nation with high-quality education (Fuadi & Irdalisa, 2022). STEM education supports the development of science literacy skills. A comparison of educational quality between Indonesia and Türkiye is highly interesting. While both countries share some cultural similarities, they differ in geographical conditions. This offers an intriguing perspective when comparing Indonesia's STEM education system with that of Türkiye. Türkiye already has a good science index compared to Indonesia (Sari & Wardani, 2018; Sugandi & Delice, 2014). Science is seen as an "organized body of knowledge," encompassing steps of the scientific method: (1) problem identification, (2) data examination, (3) hypothesis formulation, (4) experimentation, and (5) conclusion drawing (Vom Brocke et al., 2020).

Discussing further into the comparison of science curricula between Indonesia and Türkiye, it is essential to understand the broader context of their education systems and the motivations behind their respective curriculum reforms. Indonesia and Türkiye share the common goal of improving their education systems to compete effectively on the global stage and equip their youth with the skills needed for the 21st century (CANSIZ & CANSIZ, 2019b; El Islami et al., 2022). In recent years, both countries have recognized the pivotal role of science, technology, engineering, and mathematics (STEM) education in achieving these goals (Handayani et al., 2018; YUMUŞAK, 2022).

Indonesia's pursuit of educational improvement has been underscored by its commitment to the Sustainable Development Goals (SDGs), particularly Goal 4, which focuses on ensuring inclusive and equitable quality education for all (Muttaqiin, 2023)(Erwin Akib et al., 2020; Walidayni et al., 2023). In line with this commitment, Indonesia has embarked on a series of curriculum changes aimed at enhancing educational quality and relevance. The Merdeka Belajar policy, as a key component of this endeavor, seeks to modernize the education system and align it with the demands of a rapidly changing global landscape (Yudhawasthi & Christiani, 2022).

The Indonesian government has recognized the need to invest in STEM education as a means to foster innovation, critical thinking, and problem-solving skills among its students (Fernando et al., 2022).

It is intriguing to delve deeper into the differences and comparisons in the implementation of science curriculum between Indonesia and Türkiye. This comparison is conducted by analyzing the curriculum implementation, the subjects taught, and the teaching methods used in elementary schools (Sekolah Dasar or SD). The low levels of science literacy and life skills in Indonesia make it imperative to establish a national science curriculum standard (Oo et al., 2018).

With a national standard for the science curriculum, it is expected that all stakeholders in science education, including teachers, students, educational providers, and others, can understand their rights and responsibilities. This collaborative understanding will help in achieving common goals. Science literacy comprises three competencies that students must master: Explaining phenomena scientifically, Evaluating and designing scientific inquiry, and Interpreting data and evidence scientifically. This article will discuss the comparison of science curricula between Türkiye and Indonesia.

METHODOLOGY

The research methodology employed in this study is the case study method, a learning technique where students are presented with a specific problem, known as the case. This approach facilitates the exploration of real-world issues within well-defined contexts, making use of various data sources. Essentially, case studies involve the analysis of real problems using actual information. Moreover, case studies prove valuable in the development of comprehensive policies aimed at enhancing student quality, emphasizing the need for collaboration when utilizing this method.

Data for this research were collected from both Indonesia and Türkiye, primarily in the form of curriculum documents from these countries and interviews conducted via Zoom meetings. Additionally, supporting data were drawn from previous research articles. Case study methods can encompass a variety of data-gathering techniques, including observation, experiments, structured interviews, questionnaires, and documentary analysis.

In this article, we review case study methods as qualitative research approaches. This research methodology allows for an in-depth examination of the subject within a specific context, offering valuable insights and contributing to a comprehensive understanding of the topic at hand.

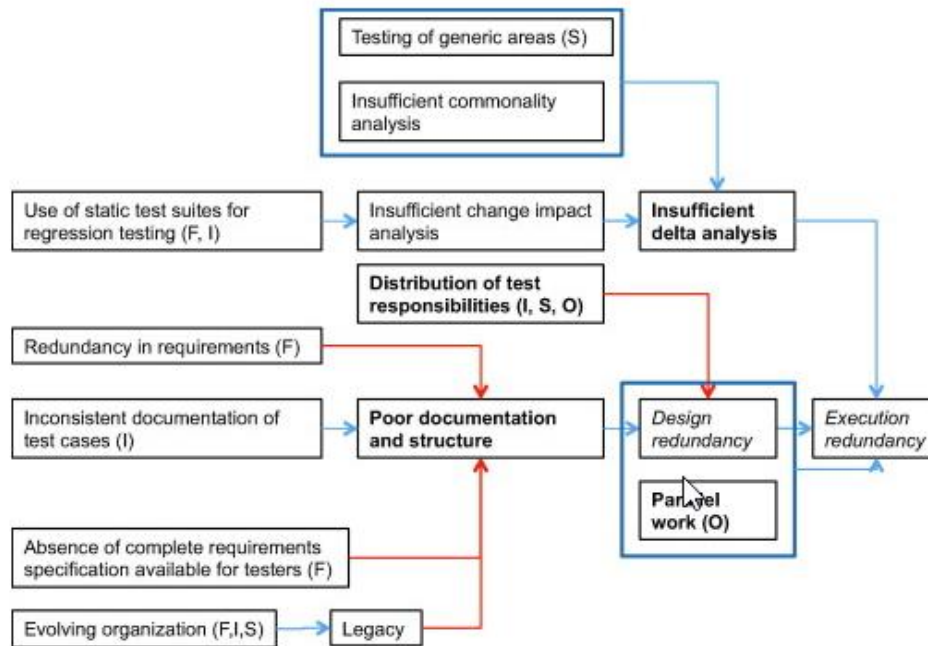


Figure 2. Case study method (Source: sciencedirect.com)

RESULT AND DISCUSSION

Review of Science Education in Türkiye

Türkiye is a democratic constitutional republic, operating under a Presidential Republic system since the era of President Recep Tayyip Erdoğan. Geographically, it spans across the Anatolian Peninsula in Southwest Asia and the Balkan region in Southeastern Europe (Saleh, 2015). The Ministry of National Education of the Republic of Türkiye, operating under the Presidency of the Republic of Türkiye and in accordance with relevant laws and regulations, is responsible for overseeing the public and private education systems, agreements, and authorizations under the national curriculum. According to Law No. 3797 on the Organization and Duties of the Ministry of National Education, the Ministry currently comprises three divisions: central, provincial, and foreign. In March 2012, the National Grand Assembly approved new legislation regarding primary and secondary education, commonly referred to as "4+4+4" (4 years of primary education, first stage; 4 years of primary education, second stage; and 4 years of secondary education).

The primary aim of the education system in Türkiye is to nurture individuals with knowledge, skills, and behaviors that are integrated with the values and competencies. The curriculum has been structured based on the "General Objectives of Turkish National Education" and the "Basic Principles of Turkish National Education" as stated in Article 2 of the National Education Basic Law No. 1739. All studies are conducted through educational and training programs; this is intended to achieve the following objectives in a mutually complementary manner at the preschool, primary, and secondary education levels:

1. Supporting the healthy development of students who have completed preschool education in physical, mental, and emotional aspects, taking into consideration their individual developmental processes.

2. Students who have completed primary school have acquired a fundamental level of verbal, numerical, and scientific reasoning, social skills, and aesthetic sensitivity necessary for their daily lives, within the framework of moral integrity and self-awareness, in accordance with their developmental level and individuality, to ensure that they become individuals oriented towards a healthy life, employing...
3. Ensuring that participants who have completed secondary school embrace national and moral values, fulfill their rights and responsibilities by developing the competencies acquired in primary school, as well as obtaining basic skills and competencies stated in the "Turkish Qualifications Framework" and also in specific disciplinary areas.
4. By developing the competencies of students who have completed secondary school in primary and secondary schools, adopting national and spiritual values and transforming them into a lifestyle, contributing to the economic, social, and cultural development of our country as productive and active citizens, as well as in specific disciplinary fields, thus becoming individuals who have acquired basic skills and competencies, and are ready for a profession, higher education, and life in line with their interests and abilities.

Since 2018, under the leadership of President Erdogan's new era, the education curriculum in Türkiye has been fully developed by the Ministry of National Education of the Republic of Türkiye, divided into four parts: First, Special Education and Guidance, for early childhood and special education. Second, primary education for grades 1-4. Third, secondary education for grades 5-12. Lastly, curriculum guidelines for vocational and technical education. The curriculum is detailed according to subjects.

In general, Natural Sciences are taught from grade 3 to grade 8 as outlined in a science curriculum unit. Then, for high school or grades 9-12, there is a separate curriculum specifically for subjects such as mathematics, physics, chemistry, and biology in upper secondary education. You can access this curriculum on the Ministry of National Education of Türkiye's website.

The allocation of time for science learning in one year in Türkiye varies depending on the grade level and curriculum guidelines:

Table 1. Science learning time allocation

Grade	Study hour	Student achievement competencies
3	108	36
4	108	46
5	144	36
6	144	59
7	144	67
8	144	61

The curriculum structure for science education in Türkiye is meticulously organized and complex, encompassing expected learning outcomes for students, instructional materials, and examples of teaching aids that can be utilized. The subjects to be studied in one academic year, from grades 1 to 8, are consistent and include topics such as Earth and the universe, creatures and life, materials and nature, and physical phenomena. Starting from grade 4, students are expected to effectively present their products at the Year-End Science Festival, which includes practical science, technology, and entrepreneurship.

Table 2. Science learning area grade 3

Grade 3					
No.	Unit name	Subject Area Name	Number of competencies	Study hour	Hour Percentage %
1	Let's Get to Know Our Planet	Earth and universe	5	9	8.3
2	Our Five Senses	Creatures and life	3	6	5.6
3	Get to know strength	Physical phenomena	4	15	13.9
4	Get to know the material	Matter and nature	4	17	15.7
5	Light and sound around us	Physical phenomena	8	21	19.4
6	Journey to the World of the Living	Creatures and life	8	18	16.7
7	Electricity	Physical phenomena	4	22	20.4
Total			36	108	100

In the science curriculum for 3rd-grade primary school students, the focus is primarily directed towards teaching them how to maintain the health of their five senses and safety in their daily activities, as well as identifying potential sources of accidents from objects around them. Additionally, students are taught to categorize the properties of materials and substances and gain an understanding of the Earth's forms and its geological structure.

Table 3. Science learning area grade 4

Grade 4					
No.	Unit name	Subject Area Name	Number of competencies	Study hour	Hour Percentage %
<i>* According to the guidelines in the Science, Technology, and Entrepreneurship Applications section, students are expected to create applications throughout the year.</i>					
1	the earth's crust and the movement of our earth	Earth and universe	5	15	13,9
2	Our food	Creatures and life	6	18	16,7
3	Strength effect	Physical phenomena	5	12	11,1
4	Properties of matter	Matter and nature	10	21	19.4
5	Lighting and sound technology	Physical phenomena	12	21	19.4
6	Humans and the environment	Creatures and life	2	6	5.6
7	Simple circuit elements	Physical phenomena	3	6	5.6
<i>Science, Technology, and Entrepreneurship Practice: Year-End Science Festival (Students are expected to effectively present their products throughout the year.)</i>				9	8.3
Total			46	108	100

In the 4th-grade science curriculum, the emphasis is placed on the movement of the Earth and the structure of its surface, the sources of energy in food for the human body, food conservation, and an introduction to simple electrical circuits. Teaching aids and students' creativity are intensively developed starting in grades 5 and 6, incorporating activities such as drawing, environmental analysis, and drawing conclusions from an early age. Complex learning and students' sensitivity are highly needed.

There is a notable difference from the 3rd-grade curriculum, as students from grades 4 to 8 are expected to effectively present their products at the Year-End Science Festival. While these curriculum changes have been positively received by teachers, they have also posed challenges, particularly regarding innovation in science, technology, and entrepreneurship exhibitions. Previous curricula still had unresolved issues, and teachers view these curriculum changes as requiring time for adaptation (Sarac, 2019). However, it is worth noting that this science exhibition has had a positive impact on significantly increasing students' interest in science education (Yildirim, 2018).

Science Education in Indonesia

Indonesia has undergone curriculum changes up to 13 times, including in the years 1947, 1964, 1968, 1973, 1975, 1984, 1994, 1997, 2004, 2006, 2013, Prototype Curriculum, and the Independent Learning Curriculum. Curriculum changes in Indonesia are influenced by political policies, resulting in curriculum changes occurring every five years. This aligns with the transitions in government that occur in Indonesia. As a result, frequent and rapid curriculum changes have made it challenging for the education process in Indonesia to adapt because the newly approved curriculum may not have reached the regions before changes occur. This is also influenced by Indonesia's geographical conditions, comprising multiple islands.

Indonesia has implemented the Independent Learning Curriculum, which includes several policies such as project-based learning through the Strengthening the Profile of Pancasila Students (P5) project, a focus on essential content to allow sufficient time for mastering basic literacy and numeracy competencies, flexibility in teaching to accommodate students' abilities, and local context and content.

Based on ministerial decisions regarding time allocation policies in the Independent Learning Curriculum for elementary schools, it includes intracurricular allocation and the allocation of the IPSA (Natural Sciences Learning) project.

Table 3. Allocation of Lesson Time for Natural Sciences

No	Class name	Intracurricular time allocation	Time allocation for Projects	Total
1	Elementary/MI class III-V	180	36	216
2	Elementary/MI class VI	160	32	192

Source: Ministerial Decree number 56/M/2022

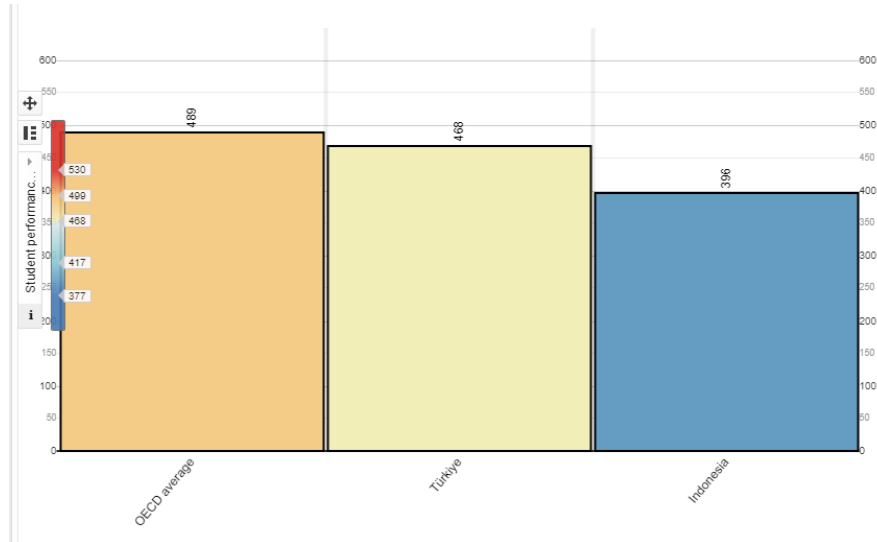
The content material taught in primary schools is divided into several phases, namely Phase A, generally for grades I and II of elementary schools (SD/MI); Phase B, generally for grades III and IV of elementary schools (SD/MI); and Phase C, typically for grades V and VI of elementary schools (SD/MI). The elements of the Science Learning Content in each phase consist of:

Phase	Element	Learning Achievement
Phase A	Understanding of IPAS (science and social)	<ol style="list-style-type: none"> 1. Environmental conditions at home and school and simple problems in everyday life 2. Five senses 3. Get to know body parts. 4. Differentiate between animals and plants. 5. Physical differences in humans 6. Family tree 7. Natural and artificial environments
	Process Skills	<ol style="list-style-type: none"> 1. Observing: at the end of the event observing phenomena and events simply through the senses 2. Asking and predicting, composing, and answering questions about surrounding objects 3. Plan and conduct simple investigations and obtain data. 4. Process, analyze data and information using methods. 5. Evaluate by comparing the results of observations. 6. Communicate the results of the investigation orally
Phase B	Understanding IPAS	<ol style="list-style-type: none"> 1. Life cycle of living things 2. Changes in matter and changes in energy 3. Social interaction 4. Local wisdom
	Process Skills	<ol style="list-style-type: none"> 1. Observing: at the end of the event observing phenomena and events simply through the senses 2. Asking and predicting,

Phase	Element	Learning Achievement
		composing, and answering questions about surrounding objects 3. Plan and conduct simple investigations and obtain data. 4. Process, analyze data and information using methods. 5. Evaluate by comparing the results of observations. 6. Communicate the results of the investigation orally
Phase C	Understanding IPAS	1. Organ Systems 2. Waves and Sound 3. Rotation and Revolution 4. Digital Maps and Conventional Maps 5. Economic Activities 6. Local Wisdom
	Process skills	1. Observing: at the end of the event observing phenomena and events simply through the senses 2. Asking and predicting, composing, and answering questions about surrounding objects 3. Plan and conduct simple investigations and obtain data. 4. Process, analyze data and information using methods. 5. Evaluate by comparing the results of observations. 6. Communicate the results of the investigation orally

Discussion

1. PISA Result



Source: (gpseduction.oecd.org)

According to the results of the 2018 PISA assessment, it is evident that Indonesia lags behind Türkiye in the Science Literacy Index. This discrepancy arises because science education in Indonesia is still predominantly focused on rote memorization rather than being contextual. Evaluation questions implemented in the curriculum lack a context-based approach; they are primarily theoretical and require memorization. However, within the framework of science literacy assessment instruments, the desired approach is one that emphasizes phenomena, context, and critical thinking.

No	Ünite Adı	Konu Alanı Adı	Kazanım Sayısı	Süre (Ders Saati)	Yüzde %
2	Hücre ve Bölünmeler	Canlılar ve Yaşam	8	16	11,1
3	Kuvvet ve Enerji	Fiziksel Olaylar	8	20	13,9
4	Saf Madde ve Karışımlar	Madde ve Doğası	16	28	19,4
5	İlgün Madde ile Etkileşim	Fiziksel Olaylar	12	26	18,05
6	Canlılarda Üreme, Büyüme ve Gelişme	Canlılar ve Yaşam	7	18	12,5
7	Elektrik Devreleri	Fiziksel Olaylar	6	8	5,6
Fen, Mühendislik ve Girişimcilik Uygulamaları: Yıl Sonu Bilim Şenliği (Öğrencilerin yıl içerisinde ortaya çıkardıkları önün etkil bir şekilde sunulmaları beklenir.)			12	8,3	
Toplam			67	144	100

No	Ünite Adı	Konu Alanı Adı	Kazanım Sayısı	Süre (Ders Saati)	Yüzde %
1	Mevsimler ve İklim	Dünya ve Evren	3	14	9,7
2	DNA ve Genetik Kod	Canlılar ve Yaşam	13	22	15,3
3	Basınç	Fiziksel Olaylar	3	10	6,9
14	Madde ve Enerji	Madde ve Doğası	17	28	19,4
15	Basit Makineler	Fiziksel Olaylar	2	10	6,9
16	Enerji Dönüşümleri ve Çevre Bilimi	Canlılar ve Yaşam	12	24	16,7
7	Elektrik Yalıtları ve Elektrik Enerjisi	Fiziksel Olaylar	11	24	16,7
Fen, Mühendislik ve Girişimcilik Uygulamaları: Yıl Sonu Bilim Şenliği (Öğrencilerin yıl içerisinde ortaya çıkardıkları önün etkil bir şekilde sunulmaları beklenir.)			12	8,3	
Toplam			61	144	100

Figure 4. Research and discussion process

Based on the results of interviews with sources residing in Turkey, which is now referred to as Türkiye, it is evident that education in Türkiye places a greater emphasis on contextual and practical learning.

2. Curriculum Structure

The curriculum structure in Türkiye is well-organized. Subtopics have predetermined time allocations in schools, providing clear guidelines for when specific topics should be taught. As a result, schools have defined timeframes and deadlines for implementing science education materials. This differs from Indonesia, where time allocation is still more generalized and lacks specificity.

In Indonesia, under the new curriculum, there are 108 hours allocated for in-class learning and 36 hours for projects in the field of science. In contrast, under the previous 2013 curriculum and the KTSP (School-Based Curriculum), science was taught only twice a week, for three hours per session or 1 hour and 30 minutes per class (Somantrie, 2021).

The curriculum structure in Türkiye is more detailed and complex, with clear objectives for students, instructional materials, and examples of teaching aids (BAL İNCEBACAK, 2022). The subjects to be studied in one year, from grades 1 to 8, are consistent and include Earth and the universe, creatures and life, materials and nature, and physical phenomena. Starting from grade 4, students are expected to effectively present their products at the Year-End Science Festival, which includes practical science, technology, and entrepreneurship projects (Uzun & Şen, 2023).

In Türkiye, students start learning basic physics concepts as early as 3rd grade, which is different from the curriculum in Indonesia, which introduces topics such as the five senses, animals, and plants.

However, based on Indonesia's new curriculum structure, the country has high expectations for improving science literacy skills. Indonesia is increasingly following the education patterns of developed countries, such as clustering primary education into Phases A, B, and C. This approach has long been practiced in other countries to align with the cognitive and social development stages of children.

3. Social and Geographic Conditions

Indonesia and Türkiye share some similarities in their patterns of social interaction, notably the majority of the population adhering to Islam. However, there are significant differences as well, such as the dominance of secularism in Türkiye. Private school teachers are required to remove the hijab as one of the conditions for employment. Türkiye's geographical location, situated at the crossroads of Asia and Europe, makes it a frequent destination for tourists.

The presence of tourists from around the world has a significant impact on the curriculum changes in Türkiye. The influx of people from various races and ethnicities in Türkiye has contributed to a more multicultural approach to education, with a diverse range of backgrounds and perspectives being integrated into the learning experience.

CONCLUSION

Based on research findings, it is evident that Türkiye's PISA scores are better than Indonesia's, with Türkiye scoring 489 points and Indonesia obtaining 396 points. Türkiye has been preparing its curriculum to align with PISA results since 2018, while in Indonesia, the curriculum changes aimed at PISA standards began in 2022 with the Independent Learning Curriculum (Kurikulum Merdeka). Türkiye follows a 4+4+4 education system, which means 4 years of primary education, 4 years of lower secondary, and 4 years of upper secondary education. This is different from Indonesia, which divides its curriculum into Phases A, B, and C for the primary level. Both Türkiye and Indonesia share the characteristic of being predominantly Muslim countries. Consequently, the content taught often has connections to Islamic values. However,

Türkiye's curriculum emphasizes secularism, separating religion from education. This differs from Indonesia, where Islamic values are integrated into the educational system.

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