

Analysis of Students' Needs and Characteristics toward Science to Support Differentiated Learning of *Kurikulum Merdeka*

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Abstract: The problem that occurs in the implementation of *Kurikulum Merdeka* is the limited of differentiated and integrated Computational Thinking (CT) teaching materials provided by the government which can be used by teachers to direct students to think computationally thinking while focus to students' learning needs, especially in science learning which is a developmental milestone of science development. The aims of the research are to analyze students' needs and character mapping of students toward the development of differentiated digital modules integrated CT in science subject. The method used in this research is a qualitative descriptive method involving 10 junior high schools that have implemented *Kurikulum Merdeka*. The population in this study was 19,034 students of 101 junior high schools in Bireuen District. Meanwhile, the sample used in this research was 260 junior high school students from 10 schools in Bireuen District. From the results of data analysis, it was found that the proportion of learning styles for junior high school students in Bireuen District is dominated by auditory learning styles. Furthermore, the distribution of multiple intelligences is dominated by students with logical/mathematic intelligence. Lastly, the student perceives that science learning is enjoyable.

Keywords: Differentiated learning; *Kurikulum merdeka*; Needs analysis; Students' characteristics

Introduction

The Industrial Revolution emerged as a result of the development of science, technology and societal culture which aimed to improve human life. Each revolution has characteristics and implications that are different from one to another, where there are technological developments in each industrial revolution (Elayyan, 2021; Lee et al., 2018). The last industrial revolution is the industrial revolution 4.0. Brought a series of changes to various aspects of human life. Industrial revolution 4.0. is an era where all technology is connected to the internet network (Ghufron, 2018; Gleason, 2018). Industrial Revolution 4.0 is a stage of knowledge development where the boundaries between physical, digital and

biological fields become blurred (Gleason, 2018; Shahroom & Hussin, 2018).

The Industrial Revolution 4.0 also results the competition in various aspects of human life. It shows through the rapid development in the world of science and technology. The education is an aspect that is affected by the era of industrial revolution 4.0 (Ghufron, 2018). The development of education must be able to comply with the developments of science and technology in the era of the industrial revolution 4.0 where the new wave of technology with intelligent manufacturing will help technology develop and lead to increased productivity. However, high-quality human resources are very necessary to be able to implement "smart manufacturing" (Tri et al., 2021). In this case, the world of education must be able to produce high quality

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human resources so that they can play an active role in the era of industrial revolution 4.0 (Elayyan, 2021; Shahroom & Hussin, 2018).

The development of quality of education is needed to produce high quality of human resources. The quality of education is the determining aspects of national development throughout the countries. Therefore, all countries in the world are trying to improve the quality of education in their respective countries. Various efforts have been made to improve the quality of education in Indonesia, especially the competency of graduates in each school. The manifestations of these efforts include expanding access to education, improving the curriculum, improving laboratory facilities, providing workshops or training for educators, and other efforts.

Since 1970, through *Instruksi Presiden (Inpres) Nomor 10 Tahun 1973 tentang Program Bantuan Pembangunan Gedung Sekolah Dasar*, Indonesia is drastically expanding access to primary education. The policy known as "*SD Inpres*" was followed by structuring the educational curriculum, training and placement of teachers, as well as adding textbooks and teaching aids to support learning. This policy has had a very striking impact in the world of education, namely increasing the number of school buildings and increasing community participation rates in primary education. The expansion of access to education in Indonesia was further strengthened in the Reform era through amendments UUD 45, namely by ensuring that the government is obliged to provide primary education services, prioritize at least 20 percent of the state revenue and expenditure budget, and organize a national education system. In this regard, the Indonesian government has established a new rule, namely *Wajib Belajar 9 Tahun* (Pusat Penelitian Kebijakan Balitbang Kemendikbud, 2020).

In addition, the government also improving the quality of education in Indonesia by paying attention to teaching staff. In terms of teaching staff or teachers, efforts to standardize teacher competency have been undertaken through UU Nomor 14 Tahun 2005 tentang Guru dan Dosen. The policy regulates minimum educational qualifications and teacher competency standards. In this case, every teacher is expected to have a minimum bachelor's or diploma IV education and have pedagogical, social, personal and professional competencies as proven by an educator certificate obtained through Professional Teacher Education.

However, various efforts to expand access to education and improve the quality of education that have been carried out by the government have not provided satisfactory results (Pusat Penelitian Kebijakan Balitbang Kemendikbud, 2020). Surveys of student learning outcomes such as the Program for International Student Assessment (PISA) found that the quality of education in Indonesia is still very low compared to

other countries and has not shown any improvement. PISA results from 2000 to 2018 show quite good performance in terms of expanding access to education carried out by the Indonesian government which can be seen from the increasing participation of school students in the PISA survey from 39% in 2000 to 85% in 2018. However, this positive development has not been followed by student learning outcomes, where the 2018 PISA scores for reading, mathematics and science abilities are respectively 371, 379 and 376. In this case, it can be seen that the learning achievements of students in Indonesia still below the average of OECD countries (Organization for Economic Cooperation and Development). Most students are not even able to achieve minimum competency in three areas, namely literacy, numeracy and science. Most of the students are not able to achieve minimum competency in these three areas, namely 70% of students do not achieve minimum competency in reading, 71% in mathematics, and 60% in science.

To overcome these problems, the government has implemented various policies to support educational changes in the industrial revolution 4.0 era, including the policy of implementing *Kurikulum Merdeka*. This policy is regulated through Kepmendikbudristek No. 56/2022 concerning Guidelines for Implementing Curriculum in the Context of Learning Recovery (*Kurikulum Merdeka*) as a complement to the previous curriculum. The minister's decision is based on the results of various national and international studies which show that Indonesia has been experiencing a learning crisis for quite a long time. These studies show that many Indonesian children are unable to understand simple reading or apply basic mathematical concepts. This situation then got worse due to the emergence of the Covid-19 pandemic.

Kepmendikbudristek Nomor 56 Tahun 2022 was then re-evaluated with the issuance of the Kepmendikbudristek Nomor 262/M/2022 which is revision of Kepmendikbudristek Nomor 56/M/2022. This decision contains the structure of *Kurikulum Merdeka*, rules related to learning and assessment, the Pancasila Student Profile Strengthening Project, as well as teacher workload. Kepmendikbudristek Nomor 262/M/2022 was further strengthened Permendikbud Nomor 5 Tahun 2022 concerning graduate competency standards and Keputusan Kepala BSKAP No.008/H/KR/2022 Tahun 2022 concerning learning outcomes in *Kurikulum Merdeka*.

Following up on several of these policies, Kepala BSKAP issued a circular letter Nomor 0574/H.H3/SK.02.01/2023 concerning Registration for the independent implementation of *Kurikulum Merdeka* for the 2023/2024 Academic Year. In this circular letter, schools can implement the *Kurikulum Merdeka* in stages

according to the readiness of their respective schools. In this circular, schools can choose one of three options for implementing the *Kurikulum Merdeka*, namely independent learning, independent change, and independent sharing.

In its application, the *Kurikulum Merdeka* provides teachers with more freedom to carry out quality learning that suits the needs of students and the learning environment. In *Kurikulum Merdeka*, students have enough time to explore concepts and strengthen competencies because *Kurikulum Merdeka* is a curriculum with diverse intracurricular learning where the content will be more optimal (Sadewa, 2022). In the learning process teachers are allowed to choose various teaching modules so that they can be adapted to the learning needs and characteristics of students (Differentiation) (Kemendikbud, 2021).

In connection with the industrial revolution 4.0, *Kurikulum Merdeka* is an optional curriculum that can reorganize the curriculum by empowering digital technology and paying attention to the growth of students' character (Kemendikbud, 2021; Rozandy & Koten, 2021; Sadewa, 2022). In this case, it is hoped that schools that have implemented *Kurikulum Merdeka*, such as driving schools, can accelerate educational transformations to at least stage 3, namely implementing education based on students' needs (differentiated) (Kemendikbud, 2021).

In implementing *Kurikulum Merdeka*, it is important for teachers to develop teaching materials by paying attention to the characteristics of the *Kurikulum Merdeka*, namely project-based learning, focus on essential material and flexibility in teaching by paying attention to the needs and characteristics of students (Kemendikbud, 2021; Rozandy & Koten, 2021; Sadewa, 2022). However, the availability of teaching materials that can support the implementation of the *Kurikulum Merdeka* provided by the government is still very minimal. The teaching materials provided are limited to teacher and student handbooks (Sharp et al., 2020). In this case, the government has not provided differentiated digital modules that are integrated with Computational Thinking (CT), where CT is one of the additional competencies in the learning system in Indonesia in accordance with the direction of the Minister of Education and Culture, Nadiem Makarim (Rozandy & Koten, 2021). The application of computational thinking is one part of strengthening fundamental competencies and holistic understanding that is emphasized in *Kurikulum Merdeka* (Christensen, 2023; Esteve-Mon et al., 2020; Li et al., 2020).

Digital modules are open materials or learning resources presented in electronic or digital form. Digital modules have more advantages compared to textbooks, namely two-way communication, clear structure or

instructions, and friendly and motivating students. (Logan et al., 2021; Syahrone et al., 2016). The benefit of digital modules is that they are more accessible and relaxing compared to printed books that have traditionally been used in the learning process. (Kowitlawakul et al., 2017; Najuah et al., 2021; Syahrone et al., 2016). In using digital modules for learning, students have the ability to review each section of the module multiple times to enhance their understanding of the content and offer self-directed learning and self-regulated learning opportunities (Bock et al., 2018; Gambo & Shakir, 2021; M. Lee et al., 2023; Öztürk & Çakıroğlu, 2021).

Related to this, before implementing a differentiated learning process integrated with computational thinking using digital modules as a form of adaptation to the industrial revolution 4.0, it is necessary to analyze the needs and characteristics of students first (Andini, 2022; Dwyer et al., 2014). Students' needs and characteristics analysis are carried out for designing differentiated digital science modules integrated with computational thinking (Christensen, 2023; Mardiyah et al., 2020; Sharp et al., 2020; Yang et al., 2021).

Differentiated learning is an instructional method where teachers plan, execute and assess class requirements according to students' learning needs to enhance learning in a supportive and stimulating environment (Maulana & Oktavia, 2023; Smale-Jacobse et al., 2019). Differentiated learning is a teaching approach where educators utilize diverse methods to cater to the unique requirements and traits of each student (Dugas, 2017; Krishan & Al-Rsa'I, 2023; Magableh & Abdullah, 2020). These needs and characteristics may include existing abilities or knowledge, learning styles, interests, and understanding of subjects (Dugas, 2017; Faigawati et al., 2023).

Basically, differentiated learning enables teachers to engage with students at a level that matches their learning stage. This approach allows teachers to select suitable content, provide diverse learning options, utilize various assessments, and adjust the learning environment to meet students' individual needs. (Maulana & Oktavia, 2023). Apart from that, teachers can also provide additional study time to specific students or, conversely, motivate high-achieving students to accelerate their learning process (Krishan & Al-Rsa'I, 2023; Smale-Jacobse et al., 2019).

The main problem in this research is the limited teaching materials that teachers can use in implementing differentiated and integrated Computational Thinking learning in the *Kurikulum Merdeka*, especially teaching materials based on digital technology. The teaching materials provided by the government to support the

implementation of the *Kurikulum Merdeka*, especially in implementing the differentiated learning process integrated with Computational Thinking, are still limited to teacher and student handbooks as found on Program Sekolah Penggerak website. (<https://psp-web.pauddikdasmen.kemdikbud.go.id/#/unduh/bahan-ajar>). Therefore, in this research, Researchers will design and implement CT-integrated differentiated science digital modules to support the implementation of *Kurikulum Merdeka*. Before developing a differentiated digital science module integrated with Computational Thinking, it is necessary to analyze the needs and characteristics of students.

Method

The research was conducted on 10 Junior High Schools in Bireuen District. The schools consist of 6 Sekolah Penggerak and 4 schools that have implemented *Kurikulum Merdeka*. The objects of this research are the students' characteristics, students' learning styles, students' multiple intelligences, digital module needs of junior high school students in Bireuen District. Meanwhile, research subjects are objects, things or people to which the research variable data is attached (Arikunto, 2013). Therefore, the subjects of this research were junior high school students in Bireuen District. The population in this study were 19,034 junior high school students from 101 schools in Bireuen District. Meanwhile, the sample used in this research was 260 junior high school students from 10 schools in Bireuen District.

The method used in this research is a qualitative descriptive method (Mistry, 2012; Nasution, 2021). In accordance with the objectives of this research, there were 4 (four) instruments used in this research, namely learning style tests, multiple intelligence tests, student characteristics questionnaires, and student needs questionnaires and interviews.

Result and Discussion

Analysis of Students' Needs

Analysis of students' needs is an important process in educational planning which aims to understand and identify the needs of individuals or groups of students. This analysis helps educators and educational institutions in designing appropriate and effective learning programs (Al-Shaboul et al., 2021; Muti'atun, 2023).

Analysis of students' needs is an ongoing process and must be adapted to changes in student development. Its aim is to ensure that the education provided meets individual needs and contributes to achieving the set learning objectives.

Students' needs and characteristics are a focus on implementing differentiated learning. The data show that there are various results on students' needs and characteristic between schools. In general, the actual science learning process is considered enjoyable as can be seen in Figure 1. However, it is necessary to explore further the reasons why students respond that learning science is quite fun, some even say it is not fun.

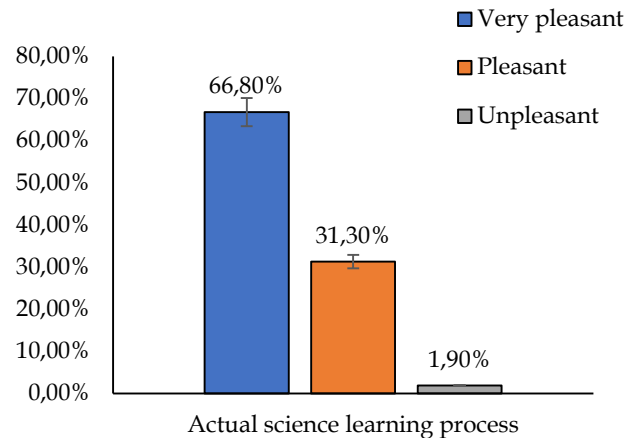


Figure 1. Actual science learning process

In addition, students feel that learning media is very important in helping students' learning process as seen in the following diagram (Figure 2).

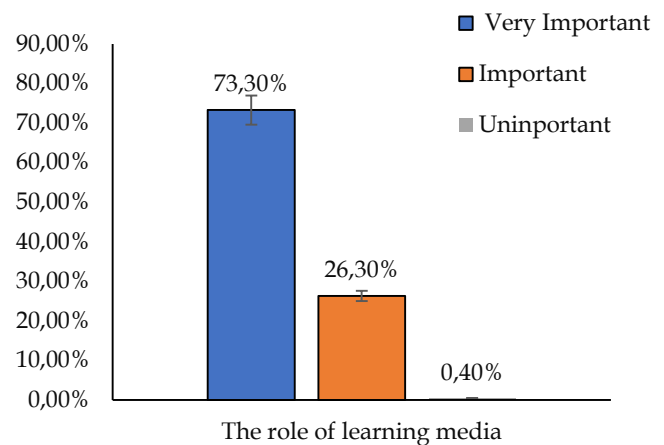


Figure 2. The role of learning media

In this case, it can be seen that the availability or existence of learning media allows students to achieve more optimal learning outcomes. Furthermore, regarding whether or not students often use learning media to help students learn, the results show that there are still many students who feel that science teachers never use learning media in the science learning process (Figure 3).

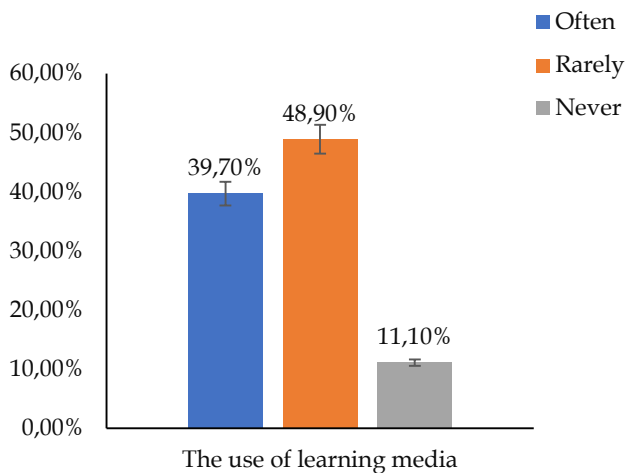


Figure 3. The use of learning media

Analysis of Students' Characteristics

Analysis of student characteristics is an important step in planning effective education. By understanding the characteristics of students, educators can design learning experiences that suit their needs and level of development (Krishan & Al-Rsa'I, 2023; Muh. Asriadi et al., 2023). There are several important aspects that need to be analyzed in student characteristics (Hidayati & Sujarwati, 2023; Pudjiati & Utami, 2023; Tyas et al., 2021). The first aspect is the age. The age of students is an important factor that influences how they learn and interact with the world around them. The learning program must be appropriate to their stage of physical and cognitive development. The second aspect is social and cultural background, social and cultural background aspect such as ethnic background, religion, cultural values, and family experiences can influence the way students interpret information and participate in learning. The third aspect is cognitive ability. Evaluation of students' cognitive abilities, including the level of understanding, analysis, and synthesis of information. This helps educators adjust the level of difficulty of learning material.

Furthermore, the fourth aspect is learning Style. Learning style identify students' learning preferences, whether they prefer to learn through visual, auditory or kinesthetic. This allows educators to provide learning materials that suit individual learning styles. The fifth aspect is Motivation. Understanding students' interests and motivation helps educators choose topics or approaches that can spark their interest and maintain their motivation to learn. The sixth aspect is special needs. If there are students with special needs, such as physical disabilities or special educational needs, this analysis needs to be carried out to provide appropriate support.

Then the seventh aspect is language Proficiency Level. Assess students' language abilities, including the

ability to read, write and speak the language used in the learning process. The eight aspects is social and emotional abilities. Understanding the social and emotional abilities of students helps in creating an environment that supports their social and emotional development. The ninth aspect is economy and access to resources. Assess students' economic situation and their access to resources such as books, technology, and educational facilities. The last aspect is prior experience. Assess students' previous educational and learning experiences to understand their educational background and identify deficiencies that need to be corrected.

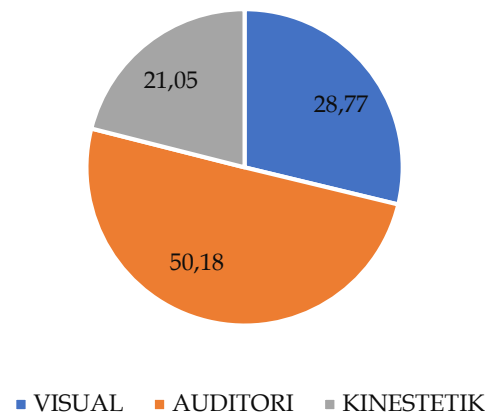


Figure 4. Students learning styles in Bireuen District

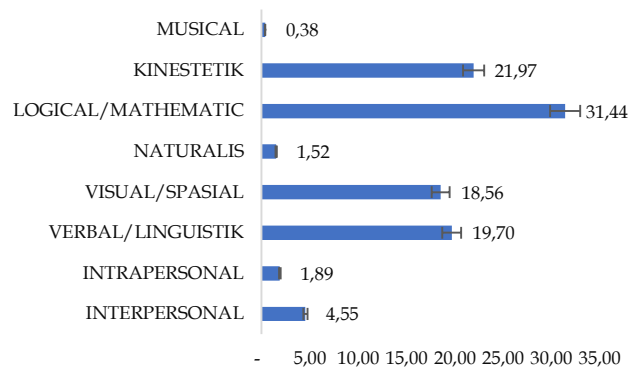


Figure 5. Student's multiples intelligence in Bireuen District

Analysis of student characteristics must be carried out comprehensively and continuously. The results of this analysis can help educators in designing appropriate learning programs and supporting holistic student development (Pudjiati & Utami, 2023; Suprayogi et al., 2017). Based on the results of data analysis, students' learning styles vary greatly in Bireuen District. However, the students' learning style is dominated by the auditory learning style, where students prefer to listen to the teacher's explanation directly or watch videos (Figure 4).

In addition, students' multiple intelligences also vary greatly as can be seen from Figure 5. The Figure 5 shows that junior high school students in Bireuen District are dominated by students with high mathematical logic skills with a percentage of 31.44%.

Conclusion

Based on the research, it can be concluded that the proportion of student learning styles between sample schools varies greatly. However, in general the proportion of learning styles for junior high school students in Bireuen District is dominated by auditory learning styles with a percentage of 50.18%, followed by visual and kinesthetic learning styles with percentages of 28.77% and 21.05% respectively. Furthermore, the distribution of multiple intelligences in the sample schools is relatively even, ranging from 4 (four) to 7 (seven) intelligences in each school. However, in general, junior high schools in Bireuen District are dominated by students with logical intelligence with a percentage of 31.44%. In contrast, only 0.38% of junior high school students in Bireuen Regency have musical intelligence. Lastly, students generally stated that the science learning process was enjoyable with a percentage of 66.80%.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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