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Literature Review: Perceptions of Junior High School Science Teachers on the Implementation of Differentiated Learning Strategies in the Independent Curriculum

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Abstract: Teacher competence in managing classroom learning through differentiation will also affect students' perceptions of the effectiveness of science learning that has been implemented. However, not all educators can implement differentiation learning techniques well. Many teachers also prefer to use the same teaching method for all students without considering their individual differences. This study aims to describe teachers' perceptions of the implementation of differentiated instruction strategies and analyze the opportunities for their application in science learning within the Merdeka Curriculum. The method used is a systematic literature review with PRISMA analysis of 10 relevant articles. The results show that teachers have a positive perception of differentiated instruction, recognizing the importance of addressing students' individual needs to create a conducive classroom environment. Differentiation strategies based on local strengths have been proven to enhance content, context, and product aspects of science literacy. Prior to implementation, students' science literacy was classified as very low in content (12.78%) and context/product (28.75%), and moderate in process (68.20%). After implementation, content increased to 70.62% (good), context or product to 43.87% (low), and science process skills to 77.18% (good). The main challenges include limited teacher competence and inadequate facilities, which must be addressed through continuous training and the use of technology.

Keywords: Differentiated instruction; Instructional strategies; Merdeka curriculum; Science learning; Teacher perception

Introduction

The Independent Curriculum emphasizes the importance of student-centered learning. According to (Witraguna et al., 2024). it explicitly emphasizes that differentiated learning meets the needs of students based on their readiness, learning outcomes, profiles, interests, and abilities. Differentiated learning recognizes that students have differences in learning styles, learning speeds, and levels of understanding. Therefore, differentiated strategies are needed to ensure that all students can reach their maximum potential. This is in line with Ki Hajar Dewantara's educational philosophy which emphasizes that students must follow their potential (Winarto et al., 2024). In an era of rapid advancement of science and technology, students need to have a deep and practical understanding of science concepts. However, in reality, many students face difficulties in understanding science material (Al Faizah et al., 2019). Various factors influence this, ranging from less interesting teaching methods, to variations in the level of understanding and abilities of each student. Therefore, the government pays serious attention to the education sector so that the country's progress can start

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better from this sector (Mhlongo et al., 2023). One of its contributions is the implementation of the Merdeka Curriculum, which also supports 21st-century learning by emphasizing the importance of differentiated learning (Yusuf & Arfiansyah, 2021). Learning in the 21st century requires teachers to prepare students to have essential skills in the era of globalization. One strategy that can be carried out by teachers is to implement differentiated learning strategies to meet students' learning needs (Maryanti & Sartono, 2024). Teachers' perceptions of the implementation of differentiation strategies in science learning will affect student activity, interest and learning outcomes (Napitupulu et al., 2023). Teacher competence in managing classroom learning in a differentiated manner will also affect students' perceptions of the effectiveness of science learning that has been implemented (Hanaysha et al., 2023). However, not all educators can implement differentiated learning techniques well. Many teachers also prefer to use the same teaching methods for all students without considering their individual differences. This can have an impact on students' views of the teacher's abilities, which in turn can affect learning outcomes and motivation in following lessons in class.

The implementation of differentiation strategies aims to pay attention to the diversity of students based on their individual characteristics. Through the application of differentiated learning in science learning, it can support teachers in adjusting the variations in students' abilities and interests. The application of differentiated learning allows teachers to create a student-centered learning environment, where each student is facilitated according to their needs, interests, and learning styles. Through this approach, students are encouraged to develop high-level thinking skills, such as the ability to innovate, think critically, and solve problems independently. In fact, junior high school/Islamic junior high school science teachers who have information about the change in science subjects in the Independent Curriculum and differentiated learning are still lacking, whereas the low knowledge of teachers certainly has an impact on the implementation of the Independent Curriculum which is not optimal. Some teachers have only heard about the Independent Curriculum and have not practiced it directly and have never used project learning in class, compiled teaching modules, project modules and their implementation in schools directly. Coupled with pedagogical competence, social competence and the application of differentiated learning of science teachers are in the low category (Darling-Hammond et al., 2020). Low pedagogical competence indicates a lack of teacher ability in adjusting learning methods to the needs of students (Ahyanuardi & Efronia, 2022). Low social competence indicates that interpersonal relationships between teachers and students are less than optimal, while the low application of differentiated learning reflects the lack of teaching strategies that are responsive to variations in students' abilities, interests, and learning styles (Muzharifah et al., 2023).

Literature study research on teacher perceptions of the implementation of differentiated learning strategies in the Independent Curriculum has been widely conducted. However, research on exploring the perceptions of junior high school science teachers towards the implementation of differentiated learning in the Independent Curriculum has never been conducted by previous researchers. Based on the results of (Mukhibat, 2023), it was revealed that differentiated strategies can improve students' learning understanding, but their application is limited by the varying readiness of teachers. A study by Langelaan et al. (2024), on differentiated learning in a progressivism perspective also highlights the need for further development in the context of science subjects. Digna et al. (2023), study on the implementation of differentiated learning includes several factors, such as the lack of teacher readiness in carrying out the necessary preparations, limited time in designing various appropriate learning variations, and increasing workload to adjust learning activities to meet the diverse needs of students. In a class consisting of students with diverse backgrounds and abilities, an effective learning strategy is needed. This strategy includes presenting content, processing information, building ideas, and reasoning that is tailored to the needs of each student. Through a differentiated learning approach, all students can learn optimally and gain relevant and meaningful learning experiences (Hasanah et al., 2022).

This also has an impact on increasing student motivation and involvement in the learning process. In addition, differentiated learning also encourages the growth of cooperation, understanding of differences, and the development of social skills between students (Fitra, 2022). The differentiation approach can reduce student boredom by adjusting the difficulty level of learning tasks or activities. Some students need higher challenges to stay engaged, while others need motivation and basic understanding. Teachers can also adjust the level of difficulty and ensure that students remain engaged and do not find learning too easy or too difficult. Each student has a different character. Not all students can grasp learning easily and quickly. Students have difficulty adapting to the new curriculum which results in less than optimal implementation of differentiated learning (Almulla, 2023). Teachers must be able to better understand the needs of students, as well as improve their technological skills in creating a more interesting and inclusive learning environment. Teachers are advised to carry out continuous

development through learning communities (Kusumaningpuri, 2024). In addition, the results of a literature study by Hidayat et al. (2024), show that research on differentiated approaches is still limited in Indonesia, so further research is needed to examine the influence of this approach on aspects such as creativity, critical thinking skills, collaboration, and problem solving, especially in science learning at the junior high or high school level (Rahmawati et al., 2025).

Based on the literature review, literature reviews that focus on exploring the perceptions of junior high school science teachers regarding the implementation of differentiated learning strategies in the Merdeka Curriculum are almost non-existent. Therefore, the researcher wants to compile a literature review related to the perceptions of junior high school science teachers towards the implementation of differentiated learning strategies in the Independent Curriculum, covering aspects of content, process, and product differentiation. The purpose of writing this literature review is to: describe teacher perceptions towards the implementation of differentiated learning strategies, and analyze learning outcomes influenced by differentiated learning strategies in science learning.

Method

This study employs a Systematic Literature Review (SLR) approach to explore the perceptions of junior high school science teachers regarding the implementation of differentiated instruction strategies in the Merdeka Curriculum. Data collection was conducted using the Publish or Perish (PoP) application, with articles sourced from two open-access databases: Google Scholar and Crossref. The search was conducted without geographic restrictions but was limited to publications in Indonesian and English. The publication year range was set between 2020 and 2025 to ensure relevance to the implementation period of the Merdeka Curriculum.

The article search used key terms such as "teacher perception," "science teacher perception," "differentiated instruction strategies," and "Merdeka Curriculum," combined with Boolean operators AND and OR. Retrieved articles were then analyzed and screened using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

The inclusion criteria were: empirical research articles using qualitative, quantitative, or mixed-method approaches (excluding SLR or pure literature studies); a research focus on science teachers' perceptions of differentiated instruction strategies; research subjects limited to elementary (SD) and junior high school (SMP) teachers; publications dated between 2020 and 2025; and articles published in nationally accredited journals (minimum SINTA 4) or reputable international journals.

The exclusion criteria included: literature reviews, systematic reviews, opinion papers, or non-research articles; articles that did not explicitly discuss science teacher perceptions or differentiated instruction strategies; research subjects outside of elementary and junior high school levels; articles that were not available in full text or were abstract-only; and duplicate articles from the two databases. Only full-text and openly accessible articles were considered.

The selection procedure involved several stages. The initial identification phase yielded 1,000 articles. After removing 150 duplicates, 90 irrelevant articles based on automatic filtering, and 60 articles that did not fit the topic, 265 articles remained for further screening. During the title and abstract screening phase, 150 articles were excluded for not aligning with the research focus. Further screening of the remaining 115 articles resulted in 10 articles that met all inclusion criteria and were used in the final analysis.

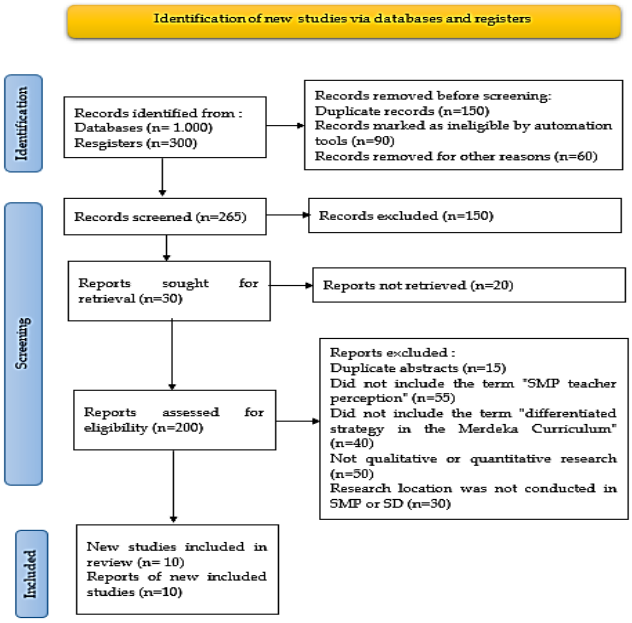

Figure 1. PRISMA flowchart analysis

Result and Discussion

Based on the results of the PRISMA diagram analysis, journal articles from 2020 to 2025 that are relevant to the title obtained 10 topics that are focused on and in accordance with the research topic. The results of the article review can be seen in Table 1.

Table 1. Analysis of Literature Review

Author Name (Year)	Journal Name (Vol, No, Page)	Article Title	Types and Methods of Research	Research Results
Rahmawati, A., Parji, and Dewi, C. (2023)	Prosiding Konferensi Ilmiah Dasar. (Hal 990-996)	Persepsi Guru Tentang Kegiatan Projek Penguatan Profil Pelajar Pancasila (P5) Sebagai Penerapan Pembelajaran Berdiferensiasi Pada Kurikulum Merdeka Era Digital	Qualitative research	The Independent Curriculum in the digital era presents a new paradigm in education, enabling teachers to become agents of change for adaptive and inclusive learning through a differentiation approach, which will help shape a superior generation ready to face future challenges.
Pesik, V. A., Dewi, A. I., Firmansyah,	Jurnal Elementaria Edukasia. (Vol	Presepsı Guru dan Sıswa terhadap Penerapan Pembelajaran Berdıferensıası Berbasıs	Qualitative research	The application of this method has a major and positive impact on the learning process. Although it is not entirely in accordance with the concept, teachers are satisfied because this method creates an active and enjoyable classroom atmosphere, while also successfully achieving learning objectives.
A., Hariana, K. (2024)	7, No 1, Hal 2462 - 2474)	Project Mata Pelajaran Senı Budaya Merdeka Belajar	Qualitative research	Teachers have a positive perception and good understanding of the concept of differentiated learning, although there are various obstacles in its application in the classroom, which occur at the beginning, implementation, and end of learning.
Fachrina, A. Z., Gusrayani, D., and Djuanda, D. (2024)	Jurnal Edu Research Indonesian Institute for Corporate Learning and Studies (IICLS). (Vol 5, No 3, Hal 30 - 39)	Persepsi Guru Mengenai Pembelajaran Berdiferensiasi di SD Negeri Gandasari II	Survey research methods	The results of the study showed that 98% of teachers had the desire to teach with differentiated learning, with 70% being able to implement it consistently, although almost 50% of teachers doubted the relevance of lessons and assignments in schools. Differentiated learning is believed to improve student learning outcomes and maximize their potential.
Winarto., Kristyaningr um, D. H., Rahayu, R., Hayu, W. R. R., Jumini, S., and n Dewi, N. D. L. (2024)	Multidisciplina ry Science Journal (Hal 1 - 8)	Science teachers' perceptions of differentiated learning: A survey study	Qualitative research	The application of the differentiation learning method in mathematics lessons has been proven effective in improving overall student achievement, although there are still challenges in its implementation.

Author Name (Year)	Journal Name (Vol, No, Page)	Article Title	Types and Methods of Research	Research Results
Syarifah, A. J., Anggoro, B. S., and Andriani, S. (2025)	Jurnal Simki Pedagogia (Vol 8, No 1, Hal 33 -43)	Analisis Implementasi Kurikulum Merdeka pada Pembelajaran Matematika Berdiferensiasi di SMP Negeri 01 Abung Barat	Qualitative research	Differentiation strategy in its implementation is adjusted to the readiness of students to learn, style and also interest in learning so that it can improve learning achievement, and three aspects of content differentiation, process, and product as optimization of the learning process.
Dinita, D. R., and Nurpratiwini ngsih, L. (2024)	Jurnal Pendidikan Dan Ilmu Sosial (2024, Vol.2, No.2, Hal: 79-85)	Strategi Implementasi Pembelajaran Berdiferensiasi Diera Kurikulum Merdeka	Qualitative research	The existence of a good influence can be seen from the significant test data between the perception of Physics science teachers towards the work environment as well as the motivation of Physics science teachers which states that both influences are real (significant).
Harefa, D. (2020)	Jurnal Education and development (Vol 8, No 3, Hal 112 - 117)	Pengaruh Persepsi Guru IPA Fisika Atas Lingkungan Kerja dan Motivasi Kerja terhadap Kinerja Guru SMA di Kabupaten Nias Selatan	Qualitative research	It is known that the understanding and implementation of differentiated learning is still limited. Only a few teachers understand differentiated learning, but most teachers have not implemented differentiated learning in their classes.
Digna, D., Minsih., and Widyasari, C. (2023)	Internasional Journal of Elementary Education (Vol 7, No 2, Hal 255 – 262)	Teachers' Perceptions of Differentiated Learning in Merdeka Curriculum in Elementary Schools	Qualitative research	The implementation of differentiated learning has been carried out well by teachers, but there is an impact that arises, namely the increase in critical and creative thinking skills in history learning.
Jumiarti, D. N., Fakhruddin, M., and Marta, N. A. (2024)	Fajar Historia Jurnal Ilmu Sejarah dan Pendidikan (Vol 8, No 1, Hal 64-77)	Implementasi Strategi Pembelajaran Diferensiasi pada Mata Pelajaran Sejarah: Studi Kasus di SMAN 23 Kabupaten Tangerang	Qualitative research, with case studies	The obstacles are the lack of inadequate facilities and infrastructure and
Pratama, R. B., and Musliman, A. (2025)	Journal of Innovation and Teacher Professionalis m (Vol 3, No 3, Hal 628 - 637)	Implementasi Pembelajaran Berdiferensiasi: Penerapan, Tantangan, Dan Solusi Di SMA Negeri 49 Jakarta	Qualitative descriptive research	Lack of learning time.

Based on the results of the article analysis, it shows that various research methods are used to explore teacher perceptions of differentiated learning in the Independent Curriculum. The following presents table 2. Research methods used in the articles analyzed.

Table 2. Methods Used in the Analysis of Research Articles

Study Topics	Research Method	Number of Studies	Study Percentage (%)
Teacher Perceptions of Science Learning	Qualitative	8	80
Study Topics	Quantitative	1	10
	Descriptive Qualitative	1	10
Total		10	100

Based on the results of the analysis of 10 articles reviewed in this systematic review, it is known that the majority of research on teacher perceptions of science learning uses qualitative methods, with a percentage of 80%. This shows that the qualitative approach is considered more relevant and effective in exploring in-depth understanding of teachers' experiences, views, and attitudes towards the implementation of differentiated learning strategies in the Independent Curriculum. Meanwhile, there is 1 article (10%) that uses a quantitative method, which generally aims to measure the influence or relationship between variables statistically, such as teacher perceptions of the work environment and motivation. In addition, there is 1 other article (10%) that uses a qualitative descriptive approach, survey, or case study, which emphasizes the exploration of phenomena in the field systematically and structured, but still in a narrative context. These results show that in the context of studying science teacher perceptions, researchers tend to choose qualitative methods to capture the diversity of views and complex dynamics in the implementation of differentiated learning in schools. Based on the interpretation of all 10 review articles above related to teacher perceptions of the implementation of differentiated learning strategies, it shows that the diversity of learning strategies and approaches is typical in different learning processes.

Teachers have the ability to adjust teaching methods, learning materials, and evaluations to suit the needs of students (Goyibova et al., 2025). In addition, cooperation and interaction between students are also emphasized to facilitate the learning process that supports each other and improves students' learning experiences and achievements (Li, 2025). The use of differentiated learning methods not only affects improving learning achievement but also on the formation of student character. However, to implement differentiated learning methods effectively, teachers need to have adequate knowledge, skills, and support. Training for teachers in implementing different learning methods and using technology as a tool is very important in dealing with the complexity of the Independent Curriculum in this digital era (Kraus et al., 2021). The results of the review above on teacher perceptions have also shown a positive attitude towards the concept of differentiated learning (definition, types, principles, and assessment). This can be seen from the teacher's perspective on differentiated learning which is in line with the first study.

Teachers see differentiated learning as a learning method that is appropriate to the needs of students, learning that is adjusted to the potential of students, and learning that involves students actively and creatively even though there are several obstacles in its implementation, but teachers have worked around these problems (Khodamoradi, 2024). One example experienced at SD Negeri Gandasari II in the results of their research is that teachers often face problems during the last lesson because students lose their enthusiasm when reflecting and evaluating (Heřmanová et al., 2024). To overcome this, teachers provide awards and incentives in the form of ice breaking so that students are more motivated. In addition, teachers also experience difficulties because students lack focus. Therefore, teachers create a supportive environment by enforcing discipline and inviting students who are less focused to learn together (De Jong et al., 2019). The implementation of differentiated learning also emphasizes that teachers must have several important skills when implementing this learning, including (Van Geel et al., 2022): creating a learning environment that can inspire students in the learning process; having the ability to stimulate students' curiosity about material concepts, solutions, problem-solving strategies, and evaluations used in learning; being able to design and organize a comfortable, safe, and motivating learning environment for students according to their learning styles, interests, and talents (Monteiro et al., 2021).

With the skills of educators, they can adjust teaching methods according to a pedagogical approach that emphasizes understanding the individual characteristics of students, which will help improve students' learning abilities according to their needs (Syafi'i et al., 2024; Kim et al., 2019). Thus, it is hoped that it can trigger students' enthusiasm for learning so that their learning needs can be met optimally. This statement is in line with the results of the study in the last review that the perception of the driving teacher at SMA Negeri 49 Jakarta learning based on local excellence in the science content aspect increased to 70.62% and was included in the good category, the science context/product increased to 43.87% and was included in the low category, and the science process aspect increased to 77.18% and was included in the good category. Although the increase is not significant, it can

be concluded that the implementation of learning based on local excellence can improve students' content, context/product, and science process abilities (Strat et al., 2024). The following is a bar chart of the opportunities for use before and after differentiation analysis learning which is shown in Figure 2.

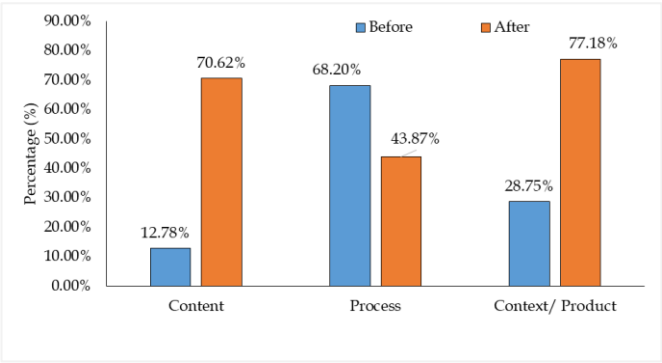

Figure 2. Bar chart of the use of differentiated learning analysis

Emphasizes that in the implementation of differentiation, environmental adjustments are needed in schools, in its implementation it requires environmental adaptation and has creative solutions to the limitations of school conditions (Wu & Tham, 2023). In the Independent Curriculum, educators must not force the will of students to follow their will, therefore, educators are required to understand the various aspects contained in students related to the learning process in the classroom, one of which is being able to master the characteristics of students from physical, moral, social and cultural, emotional and intellectual aspects (Fatimah & Muamar, 2024; Barrett et al., 2015). The differentiated learning model is a learning approach that takes into account the individual differences of each student, and provides freedom to students in the learning process (Maulana et al., 2020). Teachers' perceptions of differentiated learning strategies are also expressed in the review results above, although it shows that differentiated learning has not been implemented properly according to the actual concept (Hayden et al., 202); Pozas et al., 2023), several teachers' perceptions are very satisfied with the results of implementing differentiated learning, this is indicated by the results of increasing interest in learning and class activity which is able to create an active and enjoyable classroom atmosphere (Talbert & Mor-Avi, 2019). An example of the implementation of differentiated learning strategies in the Independent Curriculum is learning based on local excellence (Farida & Setiawan, 2022).

Before the study used a differentiated strategy, students' scientific literacy skills in the content and context aspects of science were included in the very low category, with a percentage of the content aspect of 12.78% and the context/product aspect of 28.75%, while mastery of the science process aspect was 68.20%. After differentiated learning is carried out, it is a method that adapts the content, methods, and learning outcomes according to the individual needs of students (Eikeland & Ohna, 2022; El-Sabagh, 2021; Contrino et al., 2024). This Independent Curriculum guides educators to be more flexible and innovative, but limited teacher competency and inadequate school facilities are the main obstacles (Diarera & Budiarti, 2024). Teachers need to be more active in participating in training activities and utilizing technology in the learning process. In addition, there needs to be an exchange of practices between teachers in various experiences and learning strategies so that it can be an effective step to improve teacher competence in optimizing classroom conditions (Rincon-Flores et al., 2024). It is appropriate for schools to provide facilities and resources that support the implementation of differentiated learning, such as holding routine workshops to help improve teacher understanding and teacher creativity in the relevant learning process in the classroom so that teachers can improve learning needs optimally (Hasan et al., 2023; Soleha & Asih, 2025).

In research on the implementation of differentiated learning strategies in the Independent Curriculum, qualitative methods are dominantly used to explain existing phenomena, but several studies conducted use quantitative methods. The phenomena found can be described accurately from quantitative analysis and instrument support (Kościelniak, 2022). The differentiation approach in learning allows teachers to meet the individual needs of each child in the class (Lindner & Schwab, 2020). This study also raises renewal variables, such as the use of local regional excellence instruments which are indeed important to use so that they can be applied properly in each school institution (Koh et al., 2023; Luongo et al., 2023).

Conclusion

Teachers' perceptions of the implementation of differentiation learning strategies show that teachers have a positive view of this method. Teachers also realize the importance of adjustments in the teaching and learning process that are in accordance with the individual needs of students. Teacher readiness is also needed to accommodate classes with content differentiation, process differentiation, product differentiation and paying attention to environmental conditions so that a conducive class is created. Although there are several obstacles in implementing this strategy, such as students lacking focus in the last lesson, teachers have tried various solutions, including giving awards and creating a supportive environment. Opportunities

in implementing differentiation in science learning in the Independent Curriculum show great potential to improve student achievement through the lecture method with a product differentiation approach that encourages student creativity. This supports the development of student potential and makes learning more interesting. In addition, the implementation of the product strategy provides space for students to express their creativity in completing tasks according to their respective interests and abilities. The implementation of local excellence-based differentiation learning can improve students' content, product, and science process abilities, seen from the data before the study, students' science literacy abilities in the content and context aspects of science are included in the very low category with a percentage of 12.78% content aspect and 28.75% context/product aspect, while mastery of the science process aspect is 68.2%. After local excellence-based learning was carried out, the science content aspect increased to 70.62% and was included in the good category, the science context/product increased to 43.87% and was included in the low category, and the science process aspect increased to 77.18% and was included in the good category.

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N.P.W.W conducted the research; I.W.R., I.W.S., and I.N.T reviewed and edited the manuscript. All authors have read and approved the final published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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