Implementation of Differentiated Learning Content Based on Learning Readiness on the Material of the Sine Rule in Grade XI of Senior High School

Putri Violenta Siringoringo[1], Bettisari Napitupulu[2], Agnes Teresa Panjaitan[3], Happy Lumbantobing[4], Yosefin Rianta Hadiyanti[5]
[12345]Program Studi Pendidikan Matematika, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Cenderawasih
Email : putrisiringoringo25@gmail.com

Abstract
This research is a descriptive qualitative research that aims to describe the implementation of content differentiated learning based on students' learning readiness on Sine Rule material in class XI-7 SMA Negeri 1 Jayapura. The subjects of this study amounted to 34 students who were selected using purposive sampling technique. The instruments used include teaching modules, diagnostic assessments, teacher observation sheets and individual tests. Before learning, a diagnostic assessment was conducted to categorize students into three categories of learning readiness, namely low, medium and high. The assessment results showed that the learners were divided into 7 groups: 3 low groups, 2 medium groups, and 2 high groups. The implementation of content differentiated learning based on the assessment results went very well. This is shown by the results of teacher observation by the math teacher observer of 88.175% and by the co-researcher of 90.625%, both of which are included in the excellent category. The individual test results showed that 30 out of 34 learners reached the Minimum Completion Criteria (KKM), while the 4 learners who were not complete came from groups with low learning readiness.

Keywords: *Implementation, Content Differentiated Learning, Learning Readiness, Sine Rule*

INTRODUCTION

Education plays a very important role in human life. Education is a process that aims to develop the full potential of an individual so that they can live life optimally and develop holistically in cognitive, psychomotor, and affective aspects (Aprima & Sari, 2022). In Indonesia, every citizen is guaranteed the right by the government to receive quality education. The Indonesian government has established a 12-year compulsory education policy covering elementary school (SD) to high school (SMA) as an effort to improve the quality of human resources. At each level of education, there are various sciences that are structured in the subjects taught, including mathematics.

Mathematics is a discipline that plays an important role in education and is widely applied in everyday life. Nisa et al. (2024) stated that learning mathematics can improve students' ability to think logically, systematically, critically, analytically, and creatively. In mathematics learning, both teachers and students each play an important role in achieving a learning goal. Learning goals are achieved if the learning process takes place effectively. This is supported by the opinion of Setyosari (Ramatni et al., 2023) who defines effective learning as learning that is successful in achieving learning goals as expected by the teacher.

In an effort to manage learning effectively, teachers need to design and determine relevant learning strategies. According to Nasution (2017), learning strategies are a comprehensive approach to learning in managing learning activities to deliver learning materials systematically in order to achieve predetermined learning objectives effectively and efficiently. In line with the opinion of Dick and Carey (Lamatenggo, 2020) who stated that learning strategies consist of various components of learning materials and activity procedures used by teachers in order to help students achieve learning objectives. Still in the same source, Lamatenggo (2020) stated that the selection of learning strategies is carried out by teachers by considering the conditions or situations, learning resources, characteristics, and needs of students faced in order to achieve certain learning objectives.

One of the learning strategies that teachers can apply by considering the needs and characteristics of students is differentiated learning. Differentiated learning has been known as a learning strategy that accommodates the readiness, learning interests and learning profiles

of various students (Danuri et al., 2023). Differentiated learning is learning that provides opportunities for students to learn learning materials according to the abilities, needs, and interests of each student, so that they do not experience frustration or feel like they have failed in their learning experience (Purba et al., 2021). In differentiated learning, there are three differentiation strategies that can be carried out, one of which is content differentiation (Bayumi et al., 2021)

According to (Wangge et al., 2024) content differentiation refers to learning materials provided by teachers based on mapping the needs of each student. In implementing content-differentiated learning, teachers provide different learning materials adjusted to the needs of students in terms of learning readiness related to students' abilities at the beginning of learning.

In carrying out mathematics learning activities, teachers need to understand and must pay attention to the learning readiness of each student in order to provide appropriate learning. According to Ambarita & Simanullang (2023) one of the important factors that every student must have in participating in learning is learning readiness. Learning readiness is the initial state of students that makes them ready to provide responses or answers when the learning process takes place in order to achieve certain learning goals (Sirait, 2018).

In mathematics learning, learning readiness is closely related to the initial abilities or prerequisites that students have to learn more complex material. This is in accordance with the opinion of Syifa' et al. (2023) which states that students' initial abilities are related to learning readiness to learn further material. The initial abilities or prerequisite abilities that students have greatly determine how students can learn new material. This is based on the concept of mathematics which is structured hierarchically starting from the simplest concepts to more complex concepts (Hasratuddin, 2021). This means that prerequisite abilities or knowledge are the foundation for building new knowledge. Therefore, students' learning readiness related to prerequisite abilities is very important for teachers to know before carrying out learning so that teachers can find out the level of understanding of the prerequisite material for each student and can design or plan learning based on the learning readiness of each student.

Based on the results of field observations, it shows that in the implementation of learning in schools, many mathematics teachers are found to not pay attention to the learning readiness related to the prerequisite abilities possessed by students so that students have difficulty in understanding new material. This happened in one of the schools, namely at SMA Negeri 1 Jayapura. Through a discussion with one of the grade XI mathematics teachers at SMA Negeri 1 Jayapura, it was discovered that the teacher had never accommodated the diversity of students' learning readiness by designing learning that was in accordance with this diversity. In fact, through the discussion, the teacher said that the problem that was often encountered in mathematics learning in the classroom was the lack of students' learning readiness, resulting in low student learning outcomes.

One of the mathematics materials that is often considered difficult and even frightening for students is the Rule of Sines. This happens because students do not complete their prerequisites or lack understanding of basic trigonometry concepts, such as trigonometric ratios. This causes students to have difficulty linking new material with existing knowledge. In addition, in applying the Rule of Sines, it is very important to be able to truly identify the side opposite a particular angle. A small error in this placement can lead to incorrect results. Another thing that makes students find it difficult and frightening to learn the Rule of Sines is because students tend to only memorize formulas without understanding how to use them so that when faced with varying questions, students are confused. Questions related to the Rule of Sines are not always straightforward, sometimes students must first find the other angle or side using geometric or trigonometric concepts before being able to apply the Rule of Sines to solve the problem.

The Rule of Sines material is suitable to be taught with differentiated learning because of several reasons or causes that students consider the Rule of Sines material difficult and scary as described above. The main reason why the Rule

of Sines material is suitable to be taught with differentiated learning is because students are often found to have not completed learning the prerequisite material. Students who have not completed learning the prerequisite material means they have low learning readiness. However, for students who have mastered the prerequisite material, it means they have good learning readiness, so students can easily solve questions related to the Rule of Sines. This means that the learning readiness of students in the classroom to learn the Rule of Sines material varies. Therefore, with differentiated learning, teachers can accommodate the diversity of students' learning readiness to learn the material.

As an alternative solution to the problems that have been described, teachers need to make improvements to the mathematics learning process. The improvements that teachers can make are to accommodate the diversity of students' learning readiness through appropriate learning strategies. As discussed previously, one of the learning strategies that can accommodate the diversity of students' learning readiness is content-differentiated learning. This is in line with research conducted by Wangge et al. (2024) which shows that content-differentiated learning that is adjusted to students' learning readiness in terms of mathematical abilities can contribute to increasing students' understanding in mastering the material through a series of learning activities.

Based on the explanation above, the researcher is interested in conducting research on the application of differentiated content learning that is adjusted to the learning readiness of students in mathematics lessons, especially on the Sine Rule material in class XI-7 of SMA Negeri 1 Jayapura. Therefore, the researcher will conduct research with the title "Implementation of Differentiated Content Learning Based on Students' Learning Readiness on the Sine Rule Material in Class XI-7 of SMA Negeri 1 Jayapura".

METHOD

This type of research is qualitative descriptive research. The main objective of this research is to describe or reveal the conditions of the process and results of the application of the learning using descriptions that are in accordance with the facts or what actually happened during the research. The subjects in this study were 34 students of class XI-7 SMA Negeri 1 Jayapura in the even semester of the 2024/2025 academic year. The determination of the research subjects was carried out by purposive *sampling*. The instruments in this study are the main instrument (researcher) and supporting instruments consisting of: teaching modules, diagnostic assessment test sheets, teacher observation sheets, and individual test sheets.

Data collection techniques in this study were learning documentation, diagnostic assessment, teacher observation, and individual tests. From the results of the diagnostic assessment test, students were grouped homogeneously into 3 categories of learning readiness groups, namely groups with learning readiness (low, medium, and high). The learning process emphasized the application of differentiated content learning based on students' learning readiness on the sine rule material. In conducting the study, the researcher collaborated with the high school mathematics teacher and fellow researchers as observers in every activity carried out by the researcher.

RESULTS AND DISCUSSION (12pt)

1. Diagnostic Assessment Results

Before learning is carried out, students complete a diagnostic assessment. Diagnostic assessments are used to group students based on their learning readiness which is then used to design and implement differentiated learning so that it can meet students' learning needs. This is supported by the opinion of Jaki et al. (2021) who stated that the results of diagnostic assessments are used by teachers to diagnose students' initial abilities which will be the basis for educators to design learning activities according to the character and needs of students, as well as a basis for teachers in developing teaching modules that differentiate content, process, or product.

Based on the results of the diagnostic assessment analysis conducted, students were divided into 3 group categories, namely groups with low, medium, and high learning readiness. The diagnostic assessment test

contains prerequisite questions from the sine rule material, such as Arithmetic Operations of Multiplication of Radical Numbers, Linear Equations of One Variable, Rationalizing the Denominator of Radical Fractions, Determining the Size of Angles in Triangles, and Trigonometric Ratios of Special Angles. Students are grouped into a low learning readiness group meaning that students do not master 2 to 5 prerequisite materials from the Sine Rule material, a medium learning readiness group meaning that they do not master 1 of the 5 prerequisite materials, and a high group meaning that they have mastered all prerequisite materials. From the results of the diagnostic assessment, the researcher divided students into 7 homogeneous groups consisting of: 3 groups with low learning readiness, 2 groups with medium learning readiness, and 2 groups with high learning readiness.

2. Teacher Observation Results

Based on teacher observations conducted by both observers, it shows that the implementation of differentiated content learning based on students' learning readiness is going very well. This is shown from the results of the percentage score by the mathematics teacher, which is 88.175% and the percentage score by the research partner is 90.625%, both scores are included in the very good category.

In the process of differentiated learning content based on learning readiness, there are several important things that teachers must pay attention to, including: teaching materials sequentially, completely, and paying attention to the needs of students based on their learning readiness (low, medium, and high); creating different teaching materials based on their learning readiness; and creating different LKPD based on their learning readiness (low, medium, and high groups).

Delivering material sequentially and completely, and paying attention to students' learning readiness are efforts made by teachers to help students in the early stages of learning the material so that students can easily understand the learning material. This is in accordance with Vygotsky's theory of the Zone of Proximal Development (ZPD) and scaffolding where teachers provide assistance in the early stages of learning by delivering material sequentially, completely and as clearly as possible.

In creating different teaching materials based on students' learning readiness, researchers create and distribute different teaching materials based on each student's learning readiness. Each student from the low, medium, or high learning readiness category gets regular teaching materials. However, what makes it different is that students who are in the low learning readiness category get additional teaching materials in the form of remedial teaching materials. This is done with the aim of facilitating the needs of students whose prerequisite abilities are still lacking. Through these remedial teaching materials, students can re-learn the prerequisite material that has not been mastered so that it can help in working on the LKPD and individual tests given. Students with moderate learning readiness only get regular teaching materials. Meanwhile, students who are in the high learning readiness category get enrichment teaching materials with the aim of meeting the learning needs of students who have higher readiness than other students.

In addition to creating different teaching materials, researchers also create different LKPD based on students' learning readiness (low, medium, and high). Creating different LKPD based on students' learning readiness is an effort made by researchers to adjust learning to the different needs of students. The differences made by researchers in the LKPD groups (low, medium, and high) lie in the level of difficulty in completing each question in the LKPD.

3. Individual Test Results

Based on the results of the individual test, it was found that out of 34 people, 30 people had met the KKM (completed) and 4 people had not met the KKM (not complete) set by the school, namely 70. Students who did not complete came from groups with low learning readiness.

From the results of individual tests, it was obtained that most students from low and

medium groups were able to answer questions with a higher level of difficulty than their learning readiness level correctly. This shows that the content-differentiated learning that is applied is able to facilitate the diversity of learning needs of students based on learning readiness (low, medium, and high) by providing questions that are in accordance with the level of learning readiness of students, and can even improve the abilities of most students who are in the low and medium group categories by being able to solve questions with a higher level of difficulty compared to their level of learning readiness.

From the research that has been conducted, researchers have found several advantages of differentiated content learning based on students' learning readiness, namely:

1. By implementing differentiated content learning based on students' learning readiness, each student's learning readiness needs can be met, making it easier for students to understand the material being taught.
2. By implementing differentiated content learning based on students' learning readiness, teachers ensure that the learning provided has been adjusted to the abilities of each student so that students gain an understanding related to the material being studied according to its level of difficulty. Thus, students do not feel frustrated or fail in their learning experience, but instead feel successful in learning and are even able to improve students' abilities and motivation in learning.
3. By implementing differentiated learning, students can interact with other students who have the same abilities so that they can improve cooperation between each other in group discussions and not just rely on or depend on one or more people who are considered to be more knowledgeable.

CONCLUSION

Based on the results and discussion it can be concluded that:

1. The implementation of differentiated content learning in class XI-7 of SMA Negeri 1 Jayapura has been implemented well. This is indicated by the percentage of implementation of differentiated content learning which obtained a percentage of 88.175% from mathematics teachers and a percentage of 90.625% from fellow researchers where both percentages are included in the very good category.
2. From the results of individual tests obtained from 34 people, there were 30 students who had met the KKM (completed) and 4 people had not met the KKM (not completed) set by the school, namely 70, where the four students who had not completed came from groups with low learning readiness.

SUGGESTION

Based on the research that has been conducted, several obstacles or deficiencies were found in differentiated content learning based on students' learning readiness, namely:

1. The implementation of differentiated learning content based on learning readiness requires teachers to provide different assistance to each learning group. Teachers must divide their focus to each group, especially providing more assistance to groups with low readiness without ignoring the needs of medium and high groups.
2. Differentiated content learning based on students' learning readiness requires a lot of preparation and maturity for teachers. This is because teachers must first conduct a diagnostic assessment to determine the characteristics and needs of each student based on their learning readiness, which will then be analyzed to group students who have the same learning readiness category. In addition, teachers must also prepare varied materials or content adjusted to students' learning readiness.

The suggestions that can be given to teachers and future researchers are:

1. For teachers
   a. Teachers should be able to apply differentiated learning in schools in mathematics learning, especially in the

material on the sine rule and other mathematics topics.
   b. Teachers should maximize time in implementing differentiated learning.
   c. Teachers should really carry out diagnostic assessments before implementing differentiated learning so that the learning provided is in accordance with the learning needs of each student.
   d. Teachers should prepare all learning tools optimally before implementing differentiated learning in the classroom.
2. For further researchers
   The results of this study can be used as one of the study materials in further research on the application of content-differentiated learning on the same topic based on other student learning needs such as student learning styles and learning profiles.

ACKNOWLEDGEMENT

Thanks are conveyed to the parties who helped the researcher in carrying out the research, namely:

1. Mrs. Dr. Bettisari Napitupulu, M. Sc. and Mrs. Agnes Teresa Panjaitan, M. Pd. who have set aside a lot of time in the midst of their busy schedules and provided energy and thoughts to motivate, assist, and direct researchers until this research is completed.
2. Mr. Mawardi as a mathematics teacher at SMA Negeri 1 Jayapura who has supported and assisted in this research.
3. Head of the Mathematics Education Study Program who facilitates researchers to conduct research in order to complete thesis courses.
4. My beloved parents, my father the late Reinhard Siringoringo and my mother Hormaliani Sipayung who always provide love, support, and prayers so that this research can be completed well.
5. Amangboruku Manunggu Lumbanraja and book Hotni Siringoringo who have always provided moral and material support so that this research can be completed properly.
6. Sister Melva Yohanna Siringoringo and sister Lydia Carolina Siringoringo as the researcher's siblings who always provide support, motivation, and prayers to the researcher.

BIBLIOGRAPHY

Ambarita, J., & Simanullang, P. S. (2023). *Implementasi Pembelajaran Diferensiasi* (Dewi & A. Candra (eds.)).

Aprima, D., & Sari, S. (2022). Analisis Penerapan Pembelajaran Berdiferensiasi Dalam Implementasi Kurikulum Merdeka Pada Pelajaran Matematika SD. *Cendikia : Media Jurnal Ilmiah Pendidikan*, *13 (1)*(1), 95–101.

Bayumi, Chaniago, E., Fauzie, Elias, G., & Ahmad, Z. (2021). *Penerapan Model Pembelajaran Berdiferensiasi.pdf*.

Danuri, Waluyo, S. B., Sugiman, & Sukestiyarn, Y. L. (2023). *Model Pembelajaran Berdiferensiasi untuk Sekolah Dasar Inklusif*. Perkumpulan Rumah Cemerlang Indonesia.

Hasratuddin. (2021). Pembelajaran Matematika Sekarang dan yang akan DatangBerbasis Karakter. *Jurnal Didaktik Matematika*, *1*(2), 30–42.

Lamatenggo, nina. (2020). Pengembangan Profesionalisme Guru Melalui Penulisan Karya Ilmiah Menuju Anak Merdeka Belajar. *Pardigma Penelitian*, 85–94.

Nasution, W. N. (2017). Strategi Pembelajaran. In A. Daulay (Ed.), *G-Couns: Jurnal Bimbingan dan Konseling* (Vol. 3, Issue 1). PERDANA PUBLISHING.

Nisa, S. C., Suprapto, E., & Sari, E. (2024). Identifikasi Kemampuan Berpikir Logis Dalam Pemecahan Masalah Matematika Pada Siswa Kelas XI SMAN 6 Madiun. *Journal on Education*, *6*(4), 19945–19956. https://doi.org/10.31004/joe.v6i4.6012

Purba, M., Purnamasari, N., Soetantyo, S., Suwarma, I. R., & Susanti, E. I. (2021). Prinsip Pengembangan Pembelajaran Berdiferensiasi (Differentiated Instruction). In M. Purba, M. Y. Saad, & M. Falah (Eds.), *Pusat Kurikulum dan Pembelajaran Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi*. Pusat Kurikulum

dan Pembelajaran, Badan Standar, Kurikulum, dan Asesmen Pendidikan, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, Republik Indonesia Jalan.

Ramatni, A., Anjely, F., Cahyono, D., Rambe, S., & Shobri, M. (2023). Proses Pembelajaran dan Asesmen yang Efektif. *Journal on Education*, *05*(04), 15729–15743.

Sirait, E. D. (2018). Pengaruh Gaya dan Kesiapan Belajar terhadap Pemahaman Konsep Matematika Siswa. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *7*(3), 207–218. https://doi.org/10.30998/formatif.v7i3.2231

Syifa', H., Zawawi, I., & Huda, S. (2023). Analisis Kemampuan Berpikir Kritis Matematis Siswa Berdasarkan Kesiapan Belajar. *Ideguru: Jurnal Karya Ilmiah Guru*, *9*(1), 233–240. https://doi.org/10.51169/ideguru.v9i1.803

Wangge, F. R., Samo, D. D., Karlina, I., & Blegur, S. (2024). Desain Pembelajaran Berdiferensiasi pada Materi Trigonometri Siswa Kelas XI SMA Negeri 1 Kupang Differentiated Learning Design on Trigonometry Material for Class XI Students of SMA Negeri 1 Kupang. *MATH LOCUS: Jurnal Riset Dan Inovasi Pendidikan Matematika*, *5*(2), 79–92.