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System Literature Review: Differentiated Learning Approach in Mathematics Subjects in the Independent High School Curriculum

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Abstract

Learning mathematics at the primary and secondary levels is the key to student success in mastering and understanding mathematics. With the characteristics of diverse students' abilities in understanding and receiving mathematical material, a technique or learning approach is needed by teachers as an effort to instill basic mathematical concepts. Based on this, in the application of differentiated learning in the view of a teacher must create a strategy to meet student learning characteristics with three kinds of differences,

including differentiation of content, processes and products. This review was conducted using PRISMA with the aim of comprehensive reporting. From the results of the assessment through quality assessment, it appears that of the 15 articles that will be examined in depth, there is 1 article that passes QA. So based on the table above, this study will discuss only 7 articles. The results show that differentiated learning is very suitable to be applied.

Keywords: Differentiated Learning, Mathematical Material

1. Introduction

Learning activities are one of the most important elements in educational development efforts. One of the efforts to improve the quality of learning in the classroom is to increase the role of teachers (Kamal, 2021) ^[15]. Various methods, models and strategies have been used by teachers in teaching, but in reality, there are still many students who do not understand what the teacher explains. This is where the teacher should not give up giving explanations to students, because not all students have the same ability to receive lessons from the teacher. Likewise, students find it difficult to accept explanations from teachers, because teachers are not right for them to use methods or strategies in delivering learning in class.

Learning mathematics at the primary and secondary levels is the key to student success in mastering and understanding mathematics. One of the compulsory subjects studied in high school is that Mathematics is studied to equip students with the ability to think logically, critically, practically, be positive and have a creative spirit. This ability is needed so that students are able to survive and develop following changing conditions by utilizing the information obtained. It also functions to develop reasoning skills, as a problem-solving tool through mindsets and mathematical models, as well as a communication tool through symbols, tables, graphs, and diagrams in explaining ideas (Kamal, 2021) ^[15].

With the characteristics of diverse students' abilities in understanding and receiving mathematical material, a technique or learning approach is needed by teachers as an effort to instill basic mathematical concepts (Syarifuddin & Nurmi, 2022) ^[33]. One way of student-centered learning is by applying differentiated learning (Farid *et al.*, 2022; Herwina, 2021) ^[7, 13]. Differentiated learning is a form of effort in a series of learning that pays attention to student needs in terms of learning readiness, student learning profile, interests and talents (Tomlinson, 2001) ^[34]. This means that teachers must guide students according to their potential, interests and talents and abilities to achieve their goals. This is in line with the research that has been conducted (Damis & Muhajis, 2019; Herwina, 2021; Suwartiningsih, 2021; Syarifuddin & Nurmi, 2022) ^[5, 13, 31, 33] who showed better learning outcomes after the implementation of a differentiated learning approach.

2. Theoretical Studies

The process of cognitive development of children from birth has been classified by Piaget into 4 stages, namely the first stage called sensorimotor at the age of 18-24 months, then the second stage preoperational at the age of 2-7 years and then the concrete operational stage at the age of 7-11 years and the formal operational stage at the age of 12 years and above (Syarifuddin & Nurmi, 2022) ^[33]. This classification is only general in the age range, but each individual at the same stage has a relatively different development.

Differentiated Learning

Differentiated learning has become known in Indonesia since the first mobilizing teacher education program was held in 2020. According to (Tomlinson, 2001) [34] that differentiated learning is an effort to combine differences to obtain information, create ideas, and express or convey the results that students have learned. Differentiated learning pays great attention to the characteristics of students and their potential. This approach pays close attention to every difference that each individual has. Differentiated learning is very important to apply because each student has its own uniqueness (Astiti *et al.*, 2021) [2]. The ability of one student cannot be generalized with other students in achieving one competency, so the learning process will run optimally if we are able to optimize the potential and abilities that exist in students. The diversity of students in the classroom is still a problem for a teacher, while respect for diversity is very important to be taught in the classroom.

Furthermore, one of the most important aspects of differentiated learning strategies is the aspect of readiness to learn (readiness) (Jatmiko & Putra, 2022) [14]. The learning process carried out by paying attention to the level of readiness of students will bring students out of their comfort zone, but with the right learning environment and adequate support, they can still master new material.

Furthermore, interests and learning profiles that need to be considered in differentiated learning (Jatmiko & Putra, 2022) [14]. Interest here can be interpreted as the process of recognizing students by providing meaningful learning and stimulating new ideas that arise from each student who is connected to previous knowledge. The learning profile is seen from the tendency of the way students process what should and is being learned. This learning profile consists of learning styles, intelligence and environmental preferences. A teacher chooses different learning styles for different tasks or uses a combination learning style that is presented in such a way as to accommodate the information that has been obtained.

Based on this, in the application of differentiated learning in view (Freestone *et al.*, 2003) [9] A teacher must create a strategy to meet student learning characteristics with three kinds of differences, including differentiation of content, processes and products. Content differentiation is the input of the learning process. He is the one who will be taught or what the student wants to learn (Tomlinson, 2001) [34]. While process differentiation is adjusting the complexity of the task according to student abilities and relating it to student learning interests through the process of providing understanding in encouraging students to express ideas in a preferred way such as expressing through visual, kinesthetic or verbal (Tomlinson, 2001) [34].

Product differentiation is making adjustments to tasks seen from the readiness, interests and learning profile of students (Tomlinson, 2001) [34]. This means that assignments in the form of products will produce something different to produce student competency achievements.

3. Methodology

This review was conducted using PRISMA, which has been developed by (Page *et al.*, 2021) [23] with the aim of thorough reporting. This allows the reader to evaluate the suitability of the method and hence trustworthy results. In addition, according to (Sierra-Correa & Kintz, 2015) [29] PRISMA can provide appropriate research questions that

enable systematic studies, develop exclusion and inclusion criteria and try to analyze the publications of large scientific databases within a certain time limit. Lastly, the PRISMA statement enables a comprehensive search for terms related to innovative teaching.

To examine related publications, this study used four systematic procedures, namely identification, screening, eligibility, and inclusion. Using this strategy, authors can fully discover and synthesize research that results in a transparent and well-organized systematic literature review. Dimensions and Publish n perish with index scopus are the main sources for this systematic review investigation. The dimensions consist of about 3240 article titles, and in the publish n perish application with the scopus index there are about 200 articles related to differentiated learning approaches. Table 1 displays keywords related to articles related to differentiated learning approaches.

Table 1: Keywords used in the process of determining related literature

Database	Keywords used
	"differentiated learning approach" OR "differentiated learning"
Dimensions	AND "math subjects" OR "math learning"
	"differentiated learning approach" OR "differentiated learning"
Scopus	AND "math subjects" OR "math learning"

Next enter the filtering step. All articles were included or omitted from the study by relying on a specific set of criteria seen in Table 2. The first filtering procedure is carried out by entering keywords followed by restrictions on the year the article was published. And continued with restrictions on the criteria of articles related to the world of education.

Table 2: Eligibility criteria and exceptions

Exclusion	Inclusion	Criteria
<i>Population</i>	Study of differentiated learning approaches at high school age	Unrelated study of differentiated learning approaches at high school age
<i>Intervension</i>	action	No action
<i>Author's institution</i>	More than 2 institutions	Less than 2 institutions
<i>Outcome</i>	How to discuss differentiated learning approaches at high school age	-
<i>Study</i>	<i>Using qualitative and quantitative approaches</i>	<i>In addition to using qualitative and quantitative approaches</i>
<i>Year of publication</i>	Year 2019 - 2023	Before 2019
<i>Outour</i>	More than 2 authors	Less than 2 authors

In this study, articles or journals that will be discussed in depth must meet the following quality assessment criteria:

Table 3: Format Quality Assessment (QA) 1

Quality Assessment (QA)	Information
Quality Assesment 1	Does the article contain research results on differentiated learning approaches in subjects?
Quality Assesment 2	Is the article written by more than 2 authors?
Quality Assesment 3	Is the article written by more than 1 institution?
Quality Assesment 4	Will the article be published in 2019-2023?
Quality Assesment 5	Is the article indexed by scopus Q4?

Table 4: Quality Assessment (QA) Results

S. No	Heading	Writer	Agency
1	Kecemasan Matematis Siswa dalam Penerapan Pembelajaran Matematika pada Kurikulum Merdeka Belajar	Hajerina, Rafiq Badjeber, Indah Suciati, Abdul Manaf,	Alkhairaat University, UIN Datokarama Palu, Muhammadiyah Buton University
2	Pembelajaran Berdiferensiasi di Sekolah Menengah	Nanda Safarati, Fatma Zuhra	Almuslim Aceh University
3	Model Evaluasi Formatif-Sumatif terhadap Hasil Belajar Matematika melalui Pembelajaran Berdiferensiasi pada Peserta Didik SMA	Magy Gaspersz, Suranto, Netty Gaspersz	Yogyakarta State University, Pattimura University, High School 22 Maluku Tengah
4	Actualization Of Principal Instructional Leadership in The Implementation of Differentiated Learning to Realize Students' Well- Being	Nunuk Hariyati, Yatim Riyanto, Sujarwanto	Surabaya State University, Ahmad Dahlan University
5	Development of differentiated physics teaching modules based on kurikulum merdeka	Leni Marlina, Nuriz Dariyani, Ida Sriyanti, Sudirman, Meilinda	Sriwijaya University, High School 5 Ogan Komering Ulu,
6	Pembelajaran Berdiferensiasi pada Pembelajaran Matematika di Kurikulum Merdeka	Maria Ultra Gusteti, Neviyarni	Padang State University
7	Differentiated learning and mathematical creative thinking: the use of vos viewer in literature mapping bibliometric analysis	Nindi Sri Rahayu, Muhamad Sofian Hadi	University of Muhammadiyah Jakarta

From each paper, the answer value will be given below for each of the questions above.

Y (Yes) : for articles that pass the 5 criteria above

N (No) : for articles that do not pass the 5 criteria above.

From the results of the assessment through quality assessment, it appears that of the 15 articles that will be examined in depth, there is 1 article that passes QA. So based on the table above, this study will discuss only 7 articles. When depicted in diagram form, stages 1 – 3 will look like the following image.

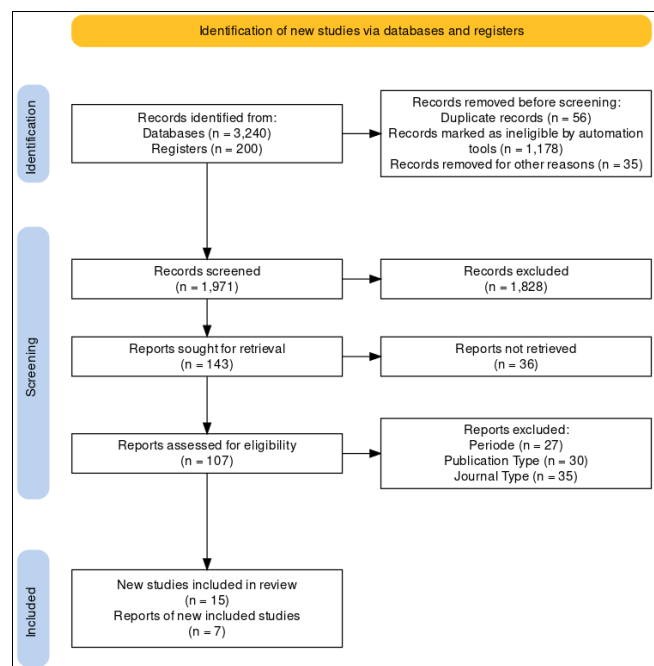


Fig 1

4. Results and Discussion

Research on differentiated learning approaches is trending today. Where every school is implementing the Independent Curriculum (Afgani, 2011; Badjeber *et al.*, 2023; Cafsoh, 2023; Gusteti & Neviyarni, 2022; L. Marlina *et al.*, 2022; Mustari, 2022; Purwowidodo & Zaini, n.d; Vica, 2023) [1, 3, 4, 11, 17, 21, 24, 35]. There are 7 articles selected based on research questions. Relying on a literature review, researchers found

that many have applied differentiated learning to mathematics subjects. This systematic review describes the various types of learning models used in applying differentiated learning, one of which is the formative – summative evaluation model (Gaspersz *et al.*, 2023) [10] and the Classroom mixed-ability model (Suyanto, 2023) [32].

In his research, differentiated learning cannot be separated from the involvement and motivation of superiors (Emat & Fahmi, 2020; Hariyati *et al.*, 2023; Milaini *et al.*, 2023; Nandang *et al.*, 2023) [6, 12, 20, 22]. School principals play an important role in encouraging the implementation of differential learning that improves student well-being (Emat & Fahmi, 2020; Hariyati *et al.*, 2023) [6, 12]. The principal performs instructional leadership actions such as communicating school goals on the implementation of differentiated learning in the classroom, supervising and evaluating learning, monitoring student progress, developing teacher professional abilities, and showing concern for teachers and students (Hariyati *et al.*, 2023; Sirait, 2021) [12, 30].

The application of differentiated learning strategies is not just to see learning outcomes (Fitra, 2022; Gaspersz *et al.*, 2023; Herwina, 2021; Laia, 2022; M. Marlina, 2020; Rahayu & Hadi, 2023; Wahyuni, 2022) [8, 10, 13, 16, 18, 25, 36], but also to reduce anxiety in learning mathematical material (Badjeber *et al.*, 2023; Shihab, 2015; Suyanto, 2023) [3, 28, 32]. Differentiated learning in Mathematics lessons in the independent curriculum, with the aim of describing the nature of differentiated learning, the principles and characteristics of differentiated learning, and analyzing opportunities for implementing differentiated learning in Mathematics learning (Gusteti & Neviyarni, 2022; Herwina, 2021; Suwartiningsih, 2021; Wahyuni, 2022) [11, 13, 31, 36].

The resulting research states that differentiated learning is very appropriate to be applied in the classroom because it is adjusted to the conditions of the class and the students themselves (Farid *et al.*, 2022; Herwina, 2021; Rosyida *et al.*, 2022; Suyanto, 2023) [7, 13, 26, 32]. The application of differentiated learning minimizes student anxiety in evaluating mathematical material (Herwina, 2021; Suyanto, 2023) [13, 32]. The success of differentiated learning by looking at the average percentage of meeting the needs of students in the group, which reached 97.67% (Suyanto, 2023) [32]. Thus, it can conclude that the differentiated

learning it does successfully meets the needs of students in their respective groups and reduces mathematical anxiety in doing evaluations.

The most dominant PTK qualitative research method and the instruments used mostly use test instruments to measure student learning outcomes. The articles also address the challenges faced in implementing differentiated learning in secondary schools, such as teachers' lack of understanding of the concept of differentiated learning and lack of support from schools (Mbabho, 2023; Safarati & Zuhra, 2023)^[19, 27].

5. Conclusion

Based on the literature review that has been conducted, it can be concluded that (a) differentiated learning has been widely applied in schools, especially in high school mathematics subjects; (b) Differentiated learning can improve student outcomes; (c) differentiated learning can reduce student anxiety in doing math evaluation problems; (d) differentiated learning is able to accommodate students' learning needs; (e) the role of superiors is also very influential on the successful application of differentiated learning in the Independent Curriculum.

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