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Differentiation Learning Models In Mathematics Of Various Levels: A Review Of Literature

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Abstract:

Differentiated learning has become known in Asia since the existence of needs of mathematics calculation program which was first held in 2020. Differentiated learning is a teaching and learning process that allows students to study subject matter based on their talents, preferences and individual requirements. Differentiated learning can support the development of learning competencies, one of which is learning mathematics. A literature review is the research approach used in this study. The publications utilized in this study were published during the previous ten years, from 2020 to 2023. Based on the search results using Google Scholar, 16 articles were found that were appropriate and related to this research. The results of the study found that the application of differentiated learning was able to improve learning outcomes, and understanding of the concept of creativity, achievement, interest, and motivation to learn.

Keywords:

Differentiation Learning, Learning Model, Mathematics Learning

Introduction:

Students in schools today come from a variety of cultures and have a variety of learning styles. They come to school with varying degrees of social and emotional maturity. The topic and intensity of their interests are vastly different. At some random time, they reflect various degrees of scholarly status in various subjects and in various parts of a subject. To make matters even more complicated, a student's readiness and interest can change over time and according to the subject matter (Tomlison, 2001). Despite the fact that educational systems all over the world have built classrooms at various student aptitude levels (tracking or streaming) to accommodate student diversity (Dupriez et al., 2008). Large-scale statistics like PISA clearly show that student population is increasingly diverse (Dixon *et al*., 2014). There is a wide range of variation among students in terms of performance, cultural background, linguistic proficiency, gender-based learning preferences, learning styles, motivations, interests, and self-regulation skills (Dijkstra *et al*., 2016; Tomlinson, 2003; Wenning, 2007). In order to meet the varied learning needs of their students, teachers need to be able to differentiate their instruction (Pozas *et al*., 2020).

When it comes to learning, children of the same age are not all the same, any more than they are in terms of stature, interests, personality, or likes and dislikes. Children share many characteristics with one another since they are humans, yet they also differ significantly. What we share is what makes us human. We are unique because of our differences. Only the resemblance of students takes centre stage

in courses with little or no differentiation instruction. In a differentiated classroom, similarities are acknowledged and built upon, but differences among students constitute a significant component of teaching and learning. In its most basic form, differentiating learning means "shaking" what happens in the classroom so that students have multiple opportunities to learn, understand, and communicate what they are learning. To put it another way, in order to enable each student to learn effectively, distinct classes offer distinct means of acquiring materials, processing or comprehending concepts, and developing products.

Researchers and policy makers encourage educators to embrace diversity and adapt teaching to meet the differentiation learning needs of students (Schleicher, 2016; Unesco, 2017). The teaching philosophy of differentiation is founded on a profound respect for students, an appreciation of their diversity, and a desire to assist all students in achieving success. These concepts suggest that teachers actively modify the curriculum, instructional methods, resources, learning activities, and student product requirements in order to better meet the learning needs of their students (C. A. Tomlinson, 2003). Differentiation instruction occurs when teachers purposefully plan for and implement modifications to enhance student learning during their lessons (Smale – Jacobse *et al.,* 2019). Differentiated learning has become known in Asia since the existence of needs of mathematics calculation program which was first held in 2020. Differentiated learning is a teaching and learning process that allows students to study subject matter based on their talents, preferences, and individual requirements (Breaux et al., 2013; Fox *et al.,* 2011; Tomlinson, 2017).

Teachers must comprehend and recognize that there is more than one technique, method, or strategy for studying a subject in differentiated learning. The teacher must plan learning materials, activities, daily assignments (both in class and at home), and the final assessment based on students' readiness to study the subject matter, what interests or things their students like to learn about, and how to deliver lessons that are in accordance with the student's learning profile. The differentiated learning model consists of three aspects, namely content differentiation, process differentiation and product differentiation .

1. Content differentiation, or what we teach children based on their interests, learning readiness, or learning profiles (visual, auditory, kinaesthetic), or a combination of the three.
2. Process differentiation, or how students will perceive the information to be studied, whether individually or in groups, by assigning tasks with different levels of difficulty, directing questions or challenges, establishing specific student agendas, altering the duration of the lesson, creating a variety of activities, and employing flexible groupings.
3. Product differentiation, specifically in the form of bills that we anticipate from students by providing them with challenges or variations and letting them select the items they are interested in Differentiated learning can support in the development of learning competencies, one of which is learning mathematics. Because learning mathematics is directed at improving life skills, especially in building creativity, critical thinking skills, collaborating or cooperating and communication skills (Rijal and Azimi, 2021).

Although differentiation learning is not a new concept in the world of education, it is still not extensively used. Teachers struggle to understand how differentiation teaching should be implemented in their classrooms, despite the widespread understanding of the concept. Therefore, researchers are interested in conducting a literature review regarding differentiated learning models in learning mathematics both from the aspects of content differentiation, process differentiation and product differentiation.

Methods:

This study used the literature review technique. The literature review research process begins with the search for papers relating to the study subject. The publications utilized in this study were published during the previous ten years, from 2020 to 2023. The first keyword "differentiated learning" and the second keyword "differentiation instruction in mathematics" were used to find publications. According to the Google Scholar search results, 16 papers were found that were relevant to this study.

Results and Discussion:

Table (1) shows the findings of an examination of 16 papers explaining the differentiated learning models:

Table: (1). Analysis of Synthesis Based on Literature Search

S. N.	Author and Year	Title	Methods	Level	Measured Variable	Result
01	Erotocritou, 2020	The Impact of Using Effective Differentiation Strategies on Students' Learning: A Case Study of an Elementary School in Dubai.	Mixed-method research design	Elementary school	Performance and learning outcomes	The implementation of an effective differentiation strategy is used to improve student learning outcomes
02	Al-Shehri, 2020	Effect of Differentiation Instruction on The Achievements and Development of Critical Thinking Skills Among Sixth-Grade Science Student.	Quasi experiment	Junior high school	Critical thinking	When differentiated instruction is used, students' critical thinking abilities improve
03	Iterbeke et al., 2020	The Effect of Ability Matching and Differentiate Instruction in Financial Literacy Educational. Evidence From Two Randomized Control Trials	Quantitative	Junior high school	Learning outcomes	Although differentiation strategies have little effect on average student learning results, non-native students gain greatly from differentiated instruction.
04	Variacion et al., 2021	Development of Differentiated Activities in Teaching Science:	Mixed-Method Research Design	Junior high school	Evacuators' Rating of Non-Differentiates Learning and The Developed Differentiated	The Developed Differentiated Learning Module and the Non-differentiated

		Educators, Evaluators and Self-Reflection on Differentiation and Flexible Learning			Learning Module	Learning Module differ significantly. According to the respondents, the Learning Module's developed Differentiated Activities encourage learner-cantered instruction.
05	Demir, 2021	The Impact of Differentiated Instructional Media on The Motivation and Opinions of Students Toward Science Learning in Terms of Learning Style	Mixed-method research design	Elementary school	Motivation Dan opinions	Differentiated learning is more effective in increasing student motivation compared to traditional learning
06	Iskandar, 2021	Increasing Student Learning Outcomes in Report Text Material through Differentiated Learning in Class IXA of SMP Nigeria 1 Shape for the 2020-2021 Academic Year	Classroom action research	Junior high school	Learning outcomes	Differentiation learning has an impact on changes in students' behaviour, resulting in increased activity & creativity
07	Bendriyanti et al., 2021	Differentiated Learning Management in Improving the Quality of Student Learning	Experiments	Junior high school	Learning quality	Differentiated learning improves the quality of learning, increases students' interest in learning languages, and makes learning more effective, creative, and enjoyable.

08	Suwartiningsih,, 2021	Application of Differentiated Learning to Improve Learning Outcomes in the Natural Science Subject, The Subject of Soil and The Sustainability of Life in Class IX b, SMP N Moneta	Class room action research	Junior high school	Learning outcomes	Learning outcomes improve with the use of differentiated learning
09	Astiti et al., 2021	Development of Connected Type Integrated Science Module Based on Differentiated Learning on Class VI Earth Layer Material	Research and Development	Elementary school	Validity and practice	Based on differentiated learning with class VII junior high school students in semester 2nd on the material layer of the earth, this study produced teaching materials in the form of a connected type Integrated IPA module. The results of the practitioner tests
10	Sanjaya, 2022	Development of Differentiated History Learning Using Book Creator Based E-Module	Development	Senior high school	Learning style	Differentiation learning has an impact on changes in students' behaviour, resulting in increased activity, creativity, and fit for purpose
11	Aprima & Sari, 2022	Analysis of The Application of Differentiated Learning in The Implementation of the "Curriculum Media" in Elementary	Qualitative Descriptive	Elementary school	Student understanding	Differentiated learning in mathematics is particularly effective because students comprehend more, and it is

		Mathematics Lesson				more enjoyable since it employs media that is applicable to every understudy's learning style
12	Yanti et al., 2022	Differentiated Social Science Learning at Bantam City High School	Qualitative	Senior high school	Student behaviour	The implementation of differentiated learning through the development of e-modules that are adapted to the needs, types and learning styles of students.
13	Van Geel, 2022	How Teachers Develop Skills for Implementing Differentiation Instruction: Helpful and Hindering Factor	Mixed research (Qualitative and Quantitative)	Primary School	Implementation Of Strategies	Teachers with less than three years of experience demonstrated significantly lower levels of differentiated learning implementation
14	Pozas et al., 2023	Teachers and Differentiation Instruction: Exploring Differentiation Practices to Address Student Diversity	Qualitative Method	All levels	Differentiated learning practices	Teachers' use of varied learning techniques is rather consistent.
15	Safarati, 2023	Literature Review: Differentiated Learning in Middle School	Literature Review	Middle School	Application Of Differentiated Learning	(a) differentiated learning has been implemented at the secondary school level; (b) student learning outcomes can be enhanced by learning differentiation; c) Differentiated

						learning can be used in all learning to meet the needs of students, (d) Instruments used in Differentiated learning research is more dominant for measuring outcomes student learning
16	Himmah and Nugraheni, 2023	Analysis of Student Learning Styles for Differentiated Learning	Qualitative Descriptive Research with Case Studies	Elementary School	Learning Styles	The findings showed that there are a variety of learning styles in Class VI. This difference is the challenge for teachers to apply differentiating learning strategies. Differentiated learning aims to facilitate students to meet their learning need

Based on the findings of an examination of 16 journal papers on differentiated learning, it can be concluded that a variety of research methods are employed, including experimentation, classroom action research, literature reviews, mixed-method research, and qualitative, quantitative, and mixed-approach studies. The research conducted still measures a lot about learning outcomes, understanding the concept of creativity, achievement, interest and motivation to learn. Teachers use instruments to observe and comprehend individual student differences in order to differentiate instruction and use that information to plan instruction (Onyishi and Sefotho, 2020; Wan, 2017).

There are several instruments used based on self-reports regarding differentiated learning practices (Coubergs et al., 2017; Prast et al., 2019; Roy et al., 2013) and instruments to measure perceived difficulty of differentiated learning strategies (Gaitas & Martins, 2017), teachers' attitudes towards differentiated learning (Coubergs *et al.*, 2017) and teacher self-efficacy related to differentiated learning (Prast *et al.*, 2019). Additionally, a number of lesson observation methods for determining whether a teacher employs a particular differentiation strategy are examined.

All students should receive differentiated content, method, product, and learning environment instruction from teachers. In the classroom, differentiated learning enables educators to

accommodate students with varying abilities and challenges (Meyad, et al., 2014; Chamberlin M. and Powers, 2010; Flaherty, 2010; Thakur, 2014). Studies conducted by Garba and Muhammad, (2015) and Kreitzer (2016) has shown that differentiate learning has increased student achievement. Differentiated learning engages students, stimulates their interest and provides a fulfilling experience.

However, the main challenges to differentiated learning are associated with teachers, students, the school environment and differentiated learning. Teachers need professional development that explains what differentiated learning is, how to use it, and how to get to know their students better before they can fully implement it. They also need time to watch other teachers use differentiated learning. As a result, it is essential to provide teachers with assistance in overcoming the difficulties associated with implementing differentiated learning and to increase teachers' preference for it, particularly in mixed-ability classes. Training, a positive approach to its implementation, preparation time and organizational support are necessary for differentiated learning (Lunsford, 2017).

Differentiated learning is not a new thing for the world of education in Indonesia. This can be seen from the existence of several studies that have been carried out as follows:

1. Differentiated learning helps improve the quality of learning, students' interest in learning language, learning is more effective, creative, and fun (Bendriyanti et al., 2021);
2. Differentiated learning has an impact on changes in student behavior, students are more active, creative and fit for purpose (Yanti *et al.,* 2022);
3. The implementation of differentiated learning through the development of e-modules that are adapted to the needs, types and learning styles of students (Sanjaya, 2022);
4. Differentiated learning in mathematics is particularly effective because students understand more, and it is interesting because it uses media that is appropriate to each student's learning style (Aprima and Sari, 2022).
5. Differentiated learning can support the development of learning competencies, one of which is learning mathematics. Because learning mathematics is directed at improving life skills, especially in building creativity, critical thinking skills, collaborating or cooperating and communication skills (Rijal and Azimi, 2021).

Conclusions: Based on the literature review that has been done, it can be concluded that

1. The application of differentiated learning can improve learning outcomes, understanding the concept of creativity, achievement, interest and motivation to learn;
2. Several types of research have been used in differentiated learning including using classroom action research, literature reviews, qualitative, quantitative, mixed-method research and experiments. While this type of development research is still not much done;
3. Differentiated learning can support the development of competence in learning mathematics.

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