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THE DESIGN AND DEVELOPMENT OF DIFFERENTIATED MATHEMATICS TEACHING MODULES BASED ON MULTIPLE INTELLIGENCE

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ABSTRACT
Differentiated learning is becoming increasingly important in the world of education because each student has different characteristics and learning needs. Students have different backgrounds, experiences, interests, and intelligence, such as visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, musical-rhythmic, interpersonal, and intrapersonal intelligence. Multiple intelligence is a theory that states that each individual has several different types of intelligence or intelligence. Every individual has unique and different multiple intelligences. This research aims to obtain a differentiated mathematics learning tool based on multiple intelligences that meets valid and practical criteria. The learning tool in question is a Learning Implementation Plan which was developed according to the principles of differentiated learning based on multiple intelligences. The design used in this research is Research and Development. The stages or procedures of this development research refer to five main steps, namely needs analysis; product development (teaching materials); expert validation and product revision, and small-scale field trials. Data collection techniques use interviews, questionnaires, observations, and validation sheets. The results of the expert validation analysis of the RPP are included in the very valid criteria with an average validity value of 3.88 and the results of the response analysis obtained a score of 90.10 with very practical criteria. Differentiation in this research is based on the multiple intelligences of diverse students, researchers or teachers can continue research by looking at differentiation from other relevant aspects

Keywords: *Teaching Module, Differentiated;,Multiple Intelegences*

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INTRODUCTION

This research is motivated by the problems faced by teachers in implementing differentiated learning. These problems include teachers' difficulties in identifying students' individual needs and intelligence (Milinga et al, 2023), difficulties in adapting learning to individual students' learning styles (Ayuningtyas at al, 2023), lack of understanding of how to integrate both approaches in learning (Ndu et al. al, 2022), a lack of understanding of multiple intelligences and how to integrate them into learning (Ahmed, 2022), as well as a lack of understanding that each student is a unique individual with different learning needs and preferences (Alnasser, 2021).

In differentiated learning teachers must understand students' individual learning needs and adjust teaching strategies based on these needs (Rhudumbu and Dziva, 2023). Another obstacle experienced by teachers in differentiated learning is that teachers need careful preparation and sufficient time to adapt to individual student needs (Moallemi, 2023). Therefore, teachers must gain a good understanding of differentiated learning and how to apply it effectively to facilitate the multiple intelligences of students.

Based on the background described, the formulation of the problem in this research is, (1) Do the multiple intelligence-based differentiated mathematics learning tools developed meet the valid criteria? (2) Do the multiple intelligence-based differentiated mathematics learning tools developed meet practical criteria? Mathematics learning using multiple intelligences has been applied by researchers to secondary students. The application of this learning is carried out by combining multiple intelligences with a scientific approach (Taufik and Adiastuty, 2017).

Differentiated learning in secondary education allows teachers to teach students with different learning styles through various strategies such as the use of different reading materials, the use of group activities, and different assessments (Smale-Jacobse et all, 2019). Differentiated learning can increase students' motivation and involvement in learning, as well as their learning outcomes (Suwastini et all, 2021). Several strategies that can be used to implement differentiated learning in the classroom include using different materials and resources, grouping students based on ability level, and providing feedback that is appropriate to individual student needs (Barbier et al, 2022).

The use of differentiated learning has the potential to improve the learning outcomes of high achieving students in mixed classes, effective differentiated learning must include aspects such as adapting learning materials, appropriate time management, and the use of different teaching methods (Ziernwald et al, 2022)). The novelty in this research is that it combines differentiated learning with the theory of multiple intelligences, in the form of design and development of differentiated mathematics learning tools, with an emphasis on the differences in intelligence of each student.

METHOD

The design used in this research is Research and Development. This research focuses on the design and development of differentiated mathematics learning tools based on multiple intelligences. The following chart describes the research design that has been and will be carried out in this research. In previous research, researchers have conducted research on the implementation of mathematics learning involving multiple intelligences with a scientific approach. This research produced learning tools with national articles and national proceedings. The stages or procedures of this research and development refer to the five main steps of Research and Development research developed by Sugiono (2017), namely needs analysis; product development (teaching materials); expert validation and product revision; small scale field trials; and large-scale field trials, but in this study large-scale field trials were not carried out due to time, energy and cost considerations.

At the needs analysis stage, initial analysis, student analysis, task analysis, concept analysis and formulation of learning objectives will be carried out. At the product development stage (teaching materials), multiple intelligence questionnaires and multiple intelligence-based differentiated mathematics learning tools will be prepared. At the expert validation and product revision stage, expert validation will be carried out by 2 mathematics education lecturers and 2 mathematics teachers. The results of the validation will be used as material to make improvements to the products that have been made.

In the next stage, field trials will be carried out on the revised product on a small scale. This research will be carried out in class VII at SMPN 2 Kuningan. Data collection techniques

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use interviews, questionnaires, observations, validation sheets and field notes. Interviews were carried out in a structured manner with teachers at the target schools, questionnaires were used to measure attitudes towards the use of differentiated mathematics learning tools based on multiple intelligences, observation was used to see the learning process using differentiated mathematics learning tools based on multiple intelligences, analysis of validation sheet documents was used to validate the learning tools made to 2 experts, and field notes (video records) were used to record all important events that were not recorded through observation sheets. Data analysis was carried out descriptively qualitatively on the results of interviews, questionnaire results, observations and analysis of validation sheet documents.

RESULT

The aim of this research is to obtain differentiated mathematics learning tools based on multiple intelligences that meet valid and practical criteria. At the needs analysis stage, an initial analysis is carried out, the results of the analysis of students' initial abilities show that students can compare and order various fractions including mixed fractions, carry out operations for adding and subtracting fractions, as well as performing operations for multiplying and dividing fractions with natural numbers. The curriculum applied is Independent curriculum with learning objectives using a differentiated discovery learning model through multiple intelligences. Students are expected to be able to carry out arithmetic operations in solving everyday problems. Next, at the product development stage, multiple intelligence questionnaires and multiple intelligence-based differentiated mathematics learning tools are prepared. The tools developed are teaching modules which have been developed and then validated by experts.

Table 1. Results of Revised Teaching Modules

Before Revision	After Revision
B. KEGIATAN INTI **Sintak** / **Kegiatan** **Stimulasi / Pemberian rangsangan** / Peserta didik diberi motivasi atau rangsangan untuk memusatkan perhatian pada topic menggunakan sifat-sifat operasi hitung bilangan bulat dan penggunaannya dan ,menyelesaikan masalah kontekstual. • **Visual Spatial**: Gunakan grafik dan diagram untuk mengilustrasikan konsep bilangan bulat. Siswa dapat mengamati perbandingan bilangan bulat dengan cara ini. • **Auditori**: Fasilitasi diskusi di kelas yang mendorong siswa untuk berbicara tentang konsep bilangan bulat dan mendengarkan pandangan teman-teman mereka, Lagu atau Jingle: Buat lagu atau jingle singkat yang mengajarkan konsep bilangan bulat. Siswa dapat menghafalnya untuk mengingat konsep. • **Kinestetik**: Gunakan permainan fisik yang melibatkan gerakan seperti permainan kartu bilangan bulat atau "human number line" di mana siswa harus bergerak ke lokasi yang benar berdasarkan bilangan bulat yang ditunjukkan, Papan Siswa Interaktif: Gunakan papan tulis interaktif atau perangkat lunak pembelajaran online yang memungkinkan siswa berinteraksi secara langsung dengan konsep bilangan bulat. • **Interpersonal**: Berikan proyek kepada kelompok siswa di mana mereka harus bekerja sama untuk memecahkan masalah yang melibatkan bilangan bulat, Diskusi Pasangan: Fasilitasi diskusi antara siswa dalam pasangan untuk memecahkan soal-soal bilangan bulat bersama. • **Intrapersonal**: Berikan pilihan kepada siswa untuk memilih topik atau metode pembelajaran yang paling sesuai dengan gaya belajar mereka. Ini memberi mereka	**B. KEGIATAN INTI** **Sintak** / **Kegiatan** **Stimulasi / Pemberian rangsangan** / Peserta didik diberi motivasi atau rangsangan untuk memusatkan perhatian pada topic menggunakan sifat-sifat operasi hitung bilangan bulat dan penggunaannya dan ,menyelesaikan masalah kontekstual. • **Visual Spatial: Grafik dan Diagram:** Gunakan grafik dan diagram untuk mengilustrasikan konsep bilangan bulat. Siswa dapat mengamati perbandingan bilangan bulat dengan cara ini. • **Auditori:Diskusi Kelas:** Fasilitasi diskusi di kelas yang mendorong siswa untuk berbicara tentang konsep bilangan bulat dan mendengarkan pandangan teman-teman mereka, **Lagu atau Jingle:** Buat lagu atau jingle singkat yang mengajarkan konsep bilangan bulat. Siswa dapat menghafalnya untuk mengingat konsep. • **Kinestetik: Permainan Bergerak:** Gunakan permainan fisik yang melibatkan gerakan seperti permainan kartu bilangan bulat atau "human number line" di mana siswa harus bergerak ke lokasi yang benar berdasarkan bilangan bulat yang ditunjukkan, **Papan Siswa Interaktif:** Gunakan papan tulis interaktif atau perangkat lunak pembelajaran online yang memungkinkan siswa berinteraksi secara langsung dengan konsep bilangan bulat. • **Interpersonal: Proyek Kolaboratif**: Berikan proyek kepada kelompok siswa di mana mereka harus bekerja sama untuk memecahkan masalah yang melibatkan bilangan bulat, **Diskusi Pasangan:** Fasilitasi diskusi antara siswa dalam pasangan untuk memecahkan soal-soal bilangan bulat bersama. • **Intrapersonal: Pilihan Mandiri:** Berikan pilihan kepada siswa untuk memilih topik atau metode pembelajaran

Based on table 1 above, there are revisions given by the validator, namely, for each discovery learning syntax, process differentiation activities in learning, must be explained in detail and followed by giving keywords in bold, to make it easier for readers to emphasize understanding learning integration. which is presented. As in visual spatial, the researcher added the keywords graphs and diagrams, accompanied by a detailed explanation of how to present graphs and diagrams in learning, namely use graphs and diagrams to illustrate the concept of integers. Students can observe the comparison of whole numbers in this way.

Table 2. Teaching Module Validation Result

No	Aspects/Indicator	Asessment	Criteria

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1	content appropriateness	3,81	Very Valid
2	Language	3,90	Very Valid
3	presentation	3,88	Very Valid
4	think creatively	3,92	Very Valid
	Average	3,88	Very Valid

Based on table 2 above, the results of the expert validation analysis of the teaching module are included in the very valid criteria with an average validity value of 3.88. Viewed from all aspects, the teaching module developed has met the validity criteria and can be used in the learning process. The next stage was a small scale trial carried out in class VII B of SMPN 2 Kuningan, with the following results presented in table 3.

Table 3. Results of Analysis of Teacher Responses

No	Aspects/Indicator	Asessment	Criteria
1	attractiveness	91	very practical
2	easy to use	85	very practical
3	learn to be independent	83	very practical
4	Completeness of material presentation	94	very practical
5	The instructions used are easy to understand and apply	95	very practical
6	Easy to read	86	very practical
7	Ease of understanding the material with the help of images and videos	91	very practical
8	The sentences used are easy to understand	89	very practical
	Average	90,10	very practical

Based on table 3 above, the results of the analysis of teacher responses to the teaching module are included in the very practical criteria with an average practicality score of 90.10. Viewed from all aspects, the teaching module developed meets practicality criteria and can be used in the learning process.

DISCUSSION

Teaching modules or learning implementation plans can be used by students as a learning resource for sequence and sequence material based on the analysis results obtained. The resulting lesson plan components have been modified to suit the module components recommended by the Ministry of National Education, including the front page (cover, prologue, table of contents), information page (concept map, systematic presentation of the Learning Plan, multiple intelligence components, and introduction), contents page (material, summary, example questions, video learning, relaxation activities, formative tests, and introduction to image mathematics), and back page (glossary, bibliography, answer key and discussion, and back cover). The main selling point developed in this lesson is the content of the Learning Plan which is adapted to the stages of multiple intelligences, accompanied by text, images and videos to visualize the material, and music to make it easier for students to understand the content.

In addition, questions on formative exercises and tests formed by interest-based interactive games are adapted to creative thinking indicators, so that students will get used to solving problems with different concepts and perspectives. The learning method uses lesson plans to make it easier for teachers and students (Geissdoerfer et al., 2016). The RPP validation

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procedure includes five expert validators, including three mathematics education lecturers, an information systems lecturer, and a mathematics teacher. Validator evaluation revealed that the RPP construction met the criteria of being very valid. This conclusion is consistent with states that learning tools have sufficient validity if the total average score for all minimum aspects is within the valid range (Smale-Jacobse et al., 2019).

meet all the criteria. According to research, lesson plans are considered practical teaching materials if the practicality score percentage is in the practical or very practical category (Irsalina and Dwiningsih, 2018). The results of research and development produce lesson plans based on various intelligence products that meet the criteria for validity and practicality, and can improve creative mathematical thinking abilities. These findings are consistent with previous research stating that the construction of mathematics teaching materials meets the criteria of being valid, practical and effective (Alpiani et al., 2022).

Furthermore, recent research shows that the use of multiple intelligence-based teaching materials is beneficial in mathematics learning. The learning plan based on multiple intelligences produced in this research is one of the innovations created to improve students' mathematical abilities, especially creative thinking abilities. However, in this development research, the lesson plans produced were only validated by general validators without being validated by assessment experts. One learning model whose syntax can facilitate multiple intelligence is brain-based learning (Rulyansah et al., 2017) and (Rivalina, 2020), this learning model facilitates the right and left brain to be active in the learning process (Danili and Reid, 2006).

CONCLUSION AND SUGGESTIONS

Based on the problem formulation and supported by research results, it was concluded that the differentiated mathematics teaching module based on multiple intelligences that was developed had very valid criteria and the differentiated mathematics teaching module based on multiple intelligences that was developed also had very practical criteria.

Differentiated learning can be developed by reviewing other relevant aspects, such as learning styles, students' initial mathematical abilities or students' way of thinking. This is important to follow up in subsequent research by considering differentiation of content, processes or learning products.

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