Innovation Learning Mathematics : Student Worksheets Based on *Realistic Mathematics Education* as a Solution for Increase Ability Literacy Numeracy and *Productive Struggle* Student Grade 5 Elementary School

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Abstract. Research This motivated by the existence of misconceptions experienced student Grade 5 of elementary school in learning Least Common Multiple consequence no the maximum use book eye lesson Mathematics and its unavailability Worksheets Student based on RME which can support activity student in effort reach objective appropriate learning with task development and needs students, so that impact on lowering ability literacy numeracy students. Purpose study This is Develop Worksheets Students on the material Least Common Multiple in 5th grade elementary school, obtain description Eligibility of Worksheet Student RME based, obtain description improvement ability literacy numeracy students and describe *productive struggle* student to Use of Worksheets Student based on RME. In this study This data collection was carried out with use method test in the form of giving *pre-test* and *post-test* and tested in a way quantitative through *n-gain* test for know improvement ability literacy numeracy students and non- test methods in the form of analyzed questionnaire in a way qualitative. Research This using the ADDIE model which has five stages that is *Analyze, Design, Development, Implementation, Evaluation.* The results are as follows research obtained that is Worksheet development Student based on RME using the ADDIE model, the results of the feasibility test teaching materials based on results expert *review* material eye lesson by 97.5% with very good qualification, results expert *review* design learning by 95% with very good qualification, results practitioner *review* learning by 92.5% with very good qualification, response participant educate by 95% with very good qualifications . Improvement ability literacy mathematically also shown student with score *n-gain* of 0.67 with category medium. Response results *productive struggle* student is of 2.91 which is in the category in progress. Research This show that Worksheet Student RME based on materials Least Common Multiple This worthy used and can increase ability literacy mathematical and *productive struggle* of students . Conclusion from study This is a Worksheet Student based on this RME approach can used for help participant educate 5th grade elementary school construction ability literacy mathematical student about Least Common Multiple And make *productive struggle* student is at a moderate level.

Keywords: Worksheet Student based on *realistic mathematics education*, literacy numeracy, *productive struggle*

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INTRODUCTION

In context education mathematics in Indonesia, ability literacy numeracy student become attention main, especially at the level Elementary School (SD) phase C. Literacy numeracy no only covers ability counting, but also the ability For apply draft mathematical in situation real and complete complex problems (NCTM, 2000). According to OECD (2013), literacy good numeracy is very important for prepare student face challenges in an increasingly global world complex and dynamic. This is also supported by the opinion Ekowati (2019) who conveyed that literacy numeracy is part from mathematics, so that component in implementation literacy numeracy no off from material existing coverage in mathematics. As for space scope material in literacy numeracy including: 1) numbers; 2) addition, subtraction, multiplication and division; 3) estimation; 4) patterns and probability; 5) fractions, decimals, percentages, ratios and

averages; 6) space and shapes (geometry); 7) information statistics (charts, tables and other data); and 8) size (Fianto, 2018).

At the level school basic, learning mathematics own role central in build strong foundation for skills numeracy students, who will become base for learning concepts more mathematics complex in the future. Ability literacy numeracy allow student for understand, reason, and use number in life everyday, so that important for developed since early so that students capable overcome various problem numerical and apply it in situation real (Rahmawati, 2021; Setiawan, 2022). With thus, with literacy good numeracy, students will more capable understand, reason, and use number in life everyday, so that they can overcome various problem numerical and apply it in context real.

However, based on results evaluation learning in several school basic, ability literacy numeracy student grade 5 still classified as low (Saputra et al., 2023). Lack ability This often associated with with approach lack of learning relevant with context life daily students, which causes interest Study mathematics become low and difficult in understand concepts base mathematics (Anwar & Kusuma, 2022). This is also in line with with results study Rahmawati (2021) shows that implementation RME approach to students grade 5 elementary school is able increase understanding draft mathematics and ability literacy Numeracy. Research This done with use design experiment on two group students and show that students who study with The RME approach has ability finish problem numeracy in context daily more Good compared to group control. More continue, results study Andini & Putra (2023) shows that RME approach can develop *productive* struggle among students, which means student try hard in solve appropriate problem with level ability them. With using RME, students capable apply skills numeracy in context real that improves perseverance they moment face challenge mathematics.

Therefore that, an approach that can used For increase ability literacy numeracy is *Realistic Mathematics Education* (RME). RME focuses on understanding draft through relevant context with experience daily students, so that they can to hook mathematics with life real. Driven by the principle that mathematics must meaningful for students, RME aims for build deep understanding and interest student to lesson mathematics (Gravemeijer, 2004). Approach this expected can help student to give meaning to material with more good and improve ability literacy numeracy through breakdown contextual problems (Putri & Widodo, 2020). In context this student worksheet RME based can become tool effective help for facilitate understanding - oriented learning draft.

In RME implementation, worksheet Students who are designed with good become tool important. Worksheet Student RME based can help student participate active in the learning

process encourage they for focuses on productive struggle, namely the process by which students faced with stimulating challenges thinking critical and creativity in finish problems (Hattie & Donoghue, 2016). Through productive struggle, students No only Study from mistakes, but also develop more problem-solving skills strong. Worksheet student RME based is also expected capable support *productive struggle*, namely conditions in which students faced with relevant challenges however still can overcome, so that they can Study with effort and perseverance. Conditions This believed important in build Power stand learning and ability breakdown problems and support ability literacy more numeracy both in elementary school students (Martini et al., 2021). This supported by the results study Sudrajat & Kusuma (2024) found that that RME is also effective for student with ability low in mathematics. With use context everyday, students can more easy understand numbers and concepts base mathematics, which ultimately increase literacy numeracy in a way gradually.

Various study latest support that use Worksheet Student RME based can increase understanding student in learning mathematics. For example, research by Nisa & Suryadi (2022) shows that use Worksheet Student RME based in class 5 is able to increase motivation Study student at a time literacy numeracy in a way significant. Research results This reinforced by studies others who found that participating students in learning RME based tends to experience improvement *productive struggle*, which has an impact on ability think critical and understanding draft more mathematics in depth (Andini & Putra, 2023).

However, the challenge in apply RME approach in the classroom often appear, such as lack of teacher's understanding of RME principles and limitations source power learning. Therefore that, development of Worksheet Integrated students with RME being step important for facilitate more learning effective and meaningful (Van den Heuvel- Panhuizen, 2003). With thus, developing the Worksheet Student RME based as tool help in learning mathematics become important and relevant For help student grade 5 school base in increase literacy numeracy they. This is expected No only increase results learn, but also train perseverance and trust self student in face challenge mathematics, which is essence from *productive struggle*.

Based on background behind above, research this aiming for develop worksheets RME based as effort for increase ability literacy numeracy and productive struggle. Through application of worksheet appropriate students are expected student can experience more learning interactive and relevant, as well increase understanding they to draft mathematics taught.

METHODOLOGY

Study This use *Design and Development (D&D)* method. Selection method this in accordance with objective D&D method according to Branch (2009) for create products, tools instructional and non-instructional, both new models and also refinement, its development. The ADDIE model was chosen researcher because approach this systematic in to design designed learning For increase effectiveness learning through five core stages, namely: Analysis**,** design**,** development, implementation and evaluation**.** Here is explanation of each stage according to Branch (2009) in his book *"Instructional Design: The ADDIE Approach"* which focuses on media design and development.

Analysis, at the stage this, is done analysis need For understand objective learning, characteristics students, limitations environment, and gaps knowledge or necessary skills overcome. This stage is base or understand What should achieved in the learning process. Design, after analysis finished, stage design involving design details from the program or material learning. This covering formulation objective learning, instructional strategy development, selection method, design channel activities, and tools evaluation. Branch (2009) emphasized that thorough planning at this stage This will ensure results learning in accordance with the stated objectives. Development, at the stage development, materials learning, resources power, or learning media made based on design that has been designed. Branch emphasizes importance development prototype that can tested before fully implemented, so that allow repair before used by students. Implementation, at this stage implementation, the material that has been developed applied in situation real learning. Branch suggests existence training instructor If required, for ensure implementation learning walk with effective. Evaluation, stage evaluation covers evaluation on the process and results learning. Evaluation This consists of from evaluation formative and evaluation summative. Evaluation functioning as bait come back for know effectiveness learning. The ADDIE model can seen visually on the image following:

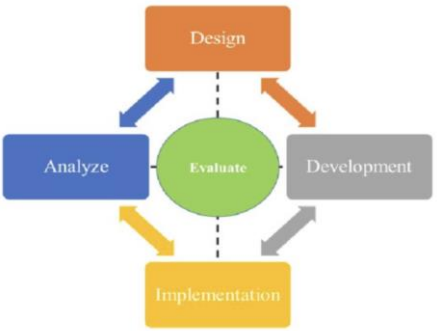


Figure 1. Stages ADDIE Method

Source : Branch (2009)

Instrument research used in research This is questionnaire expert material load aspect learning independent and stand Alone (Mufliva, 2022; Hafidzah, 2021). Questionnaire media experts include aspect media display, composition image, composition text, convenience usage, and capabilities adapt (Giwangsa, 2021; Hajidi, 2019; Mufliva, 2022). Questionnaire practitioner covering aspects of media, materials, language and support (Indrianti, 2017, Sari 2019, Hafidzah, 2021). While for questionnaire response student covering aspect convenience, motivation and power pull (Triani, et.al, 2024). Trial limited study This conducted on 30 students class 5 one of school base in Bandung City for observe response subject study to interactive digital book developed by researchers finally, after developed products get *feedback* and *reviews* from experts and participants educate, researcher enter the stage evaluation, at *the* stage this product fixed in accordance input and next applied to participants educate for to obtain description improvement ability understanding draft participant educate. Instruments used at this stage this is sheet *pre-test* and *post-test* related material data presentation. In addition that sheets are also used observation for see Power struggle productive student.

Criteria evaluation results presentation from instrument study in the form of questionnaire this arranged based on Likert scale (in Widarta, 2020) as following:

Table 1. Criteria Eligibility of Worksheet Participant Educate and Span Percentage

Score in Percent (%)	Category Eligibility
>80-100	Very good
>60-80	Good
>40-60	Enough
>20-40	Not enough
0-20	Very less

In addition to looking at the feasibility of teaching materials, the increase in students' mathematical concept understanding ability as seen from the results of the pre-test and post-test was also calculated using the N-gain calculation. The formula used to find the N-gain value and the N-gain criteria table according to Hake in (Kurniawan & Hidayah, 2021) is as follows:

$$N - gain\ (g) = \frac{skor\ posttest - skor\ pretest}{skor\ maksimal - skor\ pretest}$$

After obtaining the results of the N-gain calculation, the interpreted improvement criteria from the gain normality value according to Hake are in table 2.

Table 2. N-Gain Criteria

No	N-Gain Score	Criteria
1	0,70 ≤ n ≤ 1,00	High
2	0,30 ≤ n ≤ 0,70	Medium
3	0,00 ≤ n ≤ 0,30	Low

RESULTS AND DISCUSSION

Worksheet Participant Educate based on Realistic Mathematics Education (RME) on the material Least Common Multiple in 5th grade school base this designed with previously researcher do observation and study introduction for know difficulty study students in the eye lesson Mathematics. Activities the conducted on students 5th grade at one of the elementary schools in Bandung City which was continued with interview in a way deep. The result of course proven that the average student experiences difficulty learn on the material determine multiple communion and multiples fellowship the smallest from two numbers and determine multiple fellowship smallest in the question story That thing due to low literacy numeracy student as a result of the learning process only use source study from government (book) student.

No existence sheet Work for participant educate for students at the time Study about Least Common Multiple also participates influence low ability literacy numeracy students. Besides that, researcher find that student no understand concepts, procedures and facts as well as necessary tools used in solve problem mathematically. Based on these data, researchers conclude that student own ability literacy low mathematical. This is related with error students who are still wrong in do question related understanding conceptual and not yet control material prerequisite with intact caused boredom and boredom during learning use source learning that only in the form of book students. Besides that, the teacher doesn't develop sheet Work participant educate as material addition For learn material mathematics, so that participant educate not enough get description real about steps practical in understand concept and completion problem about Least Common Multiple. This is in line with results study Susanti, et.al (2022) showed that in students class lower school basic, implementation literacy reading, writing and literacy numeracy Still not optimal. Teacher- centered learning often limits development skills more numeracy in-depth on students. In addition that, the lack of facility supportive learning as well as limited collection books in the library make student not enough motivated for deepen literacy numeracy they.

Following this is design start of worksheet student based on RME which has developed researcher based on analysis achievement learning and adapting with principles of the RME learning model.

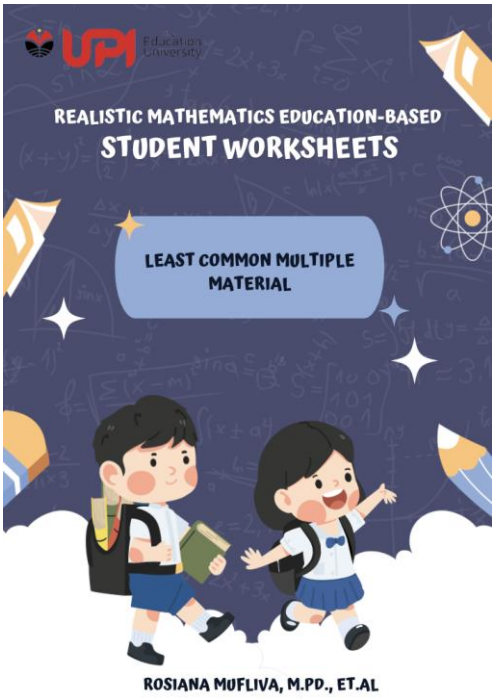


Figure 1. Initial Design of Worksheet Cover Student RME based

After develop cover, continued with compiling a foreword, table of contents, guide use of worksheets students and introduction figure. After that, researcher to design beginning question the lighter shown in Figure 2 below.

Figure 2. Initial Question Design Igniter with Worksheet Student RME based

Next, the researcher to design integrated “Let’s Play ” activities in form *barcode* as material apperception with apply *activity and reality principle* which is shown in figure 3 below. .

Figure 3. Initial Design of the “Let’s Play ” Activity with Apply *Activity and Reality Principle*

Development design beginning integrate RME principles in every his activities learning. Here This design beginning activity students who apply principle *intertwinment principle.*

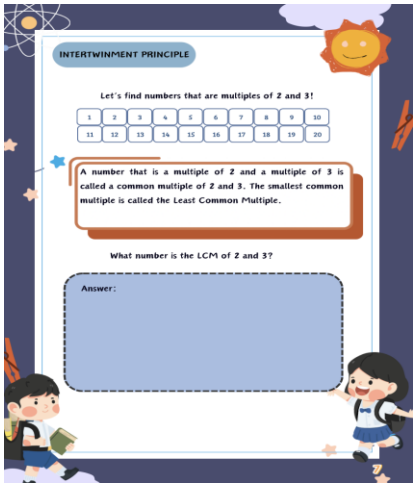


Figure 4. Initial Activity Design Learning That Apply Principle *Intertwinment Principle.*

On design beginning activity learning that applies principle *intertwinment principle*, students invited For find multiple fellowship from two number count 2 and 3. Through activity identify multiple from numbers 2 and 3, students will find a number of the same number. Numbers multiples of 2 and 3 are the same the called as multiple fellowship between numbers 2 and 3. Numbers the are 6, 12 and 18. Next, students requested determine multiple fellowship the

smallest and obtained number 6. Initial design activity learning with apply principle *level principle* shown in Figure 5 below.

Figure 5. Initial Activity Design Learning That Apply Principle *Principle Level*

On design beginning activity learning that applies *level principle*, students invited For give marks on the table about time Kely and Fathan exercise. Students asked in a way written about his findings at the time marked and requested explain in your own words in the column provided provided. Next, the initial design The “Let’s Practice ” activity is shown in Figure 6 below.

Figure 6. Initial Design of the “Let’s Go” Activity Train"

Next, the design beginning evaluation worksheet learning RME based student integrated barcode and quizziz shown in Figure 7 below.

Figure 7. Initial Evaluation Design on Worksheet Student RME based

Worksheet RME-based students on the material Least Common Multiple that has been developed has validated by experts material mathematics and education mathematics, expert design as well as expert language with criteria worthy for used in learning in elementary school according to level class. Here is summary results validation expert materials, design and language that can seen in table 2 below.

Table 2. Results of Expert Validation of Material , Design and Language on Worksheets Students On Material Least Common Multiple RME Based

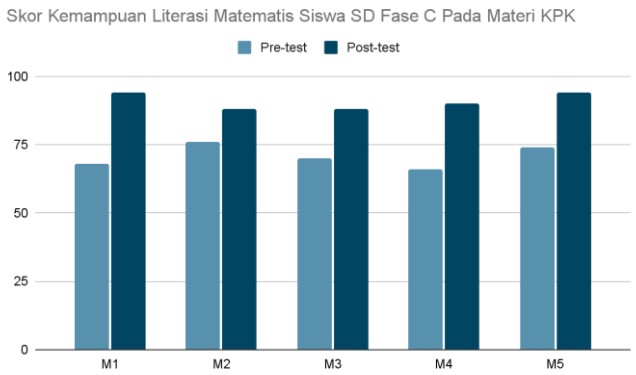
Aspect	Percent	Category
Material	97.5%	Very Good
Design	95%	Very Good
Language	92.5%	Very Good
Total Percent	95%	Very Good

Based on results validation show that Worksheet Student RME based on materials Least Common Multiple developed researcher own mark eligibility is 95% and falls into the very feasible category. The details are as follows from each aspect namely in the aspect material get percentage by 97.5%. There are suggestions from expert material related method determine multiples involving two number the remaining count There is errors, spelling and placement sign read the still Not yet right, which is caused by the editing process that has not been maximum, so that need fixed. However from side conceptual, all Topic Already

developed with right. The next aspect that is design that gets percentage by 95%. On the *template* used get advice from expert so that consider size and scale on each illustration*. The* next aspect that is aspect language, get percentage by 92.5%. There are still error writing or *typo* and necessary repaired . Therefore that, based on results validation, worksheet Student RME based very worthy for implemented with very minor improvements.

Product end of worksheet student based on RME which has validated furthermore revised with focus improvements to aesthetics design and fit illustration with material, scale and size illustration so that can help student understand mathematics in a way literate and improve ability literacy mathematically. Revision done to the Worksheet Student RME based From the side content, this RME- based LKPD No experience changes, stages learning, and context as well as still accommodate theory situation Brosseau's (2002) didactics consisting of on situation action, situation formulation, situation validation, and situations institutionalization and Harel (2008) related Triadic Cycle, includes problem contextual as input or stimulus, random mental actions, flow thinking, flow understanding, and problems contextual institutionalization as strengthening. Repair only done to design or packaged layout more colored with relevant images with characteristics student school happy base imagine.

Before implemented product end study this, *pretest* done for know description ability beginning student related ability literacy mathematical student grade 5 elementary school. Then it is done learning with worksheet student RME and student based tested return through *posttest* for to obtain description acquisition and improvement second ability. Following served chart results participant *post-test* educate on ability literacy mathematical following This .



Graph 1. *Pre-test* and *Post-test* Results Ability Literacy Mathematical Student Grade 5 Elementary School

Based on graph 1 above, can seen that all over student experience improvement ability literacy mathematics in school basic. Besides that, for see quality improvement ability literacy mathematical this, researcher measure improvement the with use *N-Gain.* Average value *N-Gain* in research this for ability understanding draft that is of 0.67. Based on criteria acquisition

mark *N-Gain* can concluded that improvement ability understanding draft mathematical student included in the category medium. That is, worksheet student RME based on materials Multiple Smallest Communion this effective in increase ability literacy mathematical student grade 5 school basic. This is relevant with results study Zahro (2017) that the worksheet student based on RME in help student understand draft mathematics through problem relevant contextual with life everyday. Research this show that development of student worksheets that focuses on problems real can strengthen ability numeracy students and improve skills think creative they in solve problem mathematics.

However, in 33% of students, changes not enough significant after study with worksheet Student *RME* based this found. This is become findings important and necessary reinforced with result data observation and interview to students. Based on scale evaluation *productive struggle* student obtained data as following.

Table 3. *Productive Struggle* Value Acquisition Student During Learning with Sheet Work Student *RME Based*

No.	Name	Aspect				Average
		Ask a Question	Encourage	Give Time	Survive	
1	M1	2.9	2.6	3.0	2.5	2.75
2	M2	2.8	2.9	3.0	3.0	2,925
3	M3	3.0	3.0	3.0	2.5	2,875
4	M4	3.2	3.2	3.0	3.2	3.1
5	M5	2.6	2.8	3.2	3.0	2.9
Average		2.9	2.9	3.04	2.84	2.91

Based on table results scale evaluation *productive struggle* to students conducted by researchers, each students average productive struggle score for in a way overall average is 2.91. This is means, the average student is in the category currently in do *productive struggle* in accordance guidelines evaluation *productive struggle* on a scale of 1-4. If the value is between 2-3 then the category moderate. However, looking at the average value for every aspect, aspect give time get highest value that is of 3.04 and aspects ask and push get same value namely 2.9. The *productive struggle aspect* that gets mark the smallest is aspect endure that is of 2.84. Based on results observation researcher, one of the weakness student in do question mathematics in class this, especially at the time measured ability literacy mathematically is weakness power stand they are at the moment experience deadlock and easy give up, so that No answer become decision students in condition which resulted in get mark zero for every question. Besides that, from aspect ask , lack of desire for look for know more in about material to teachers also become obstacle Study they. Most of them student

tend to be silent and resigned moment experience constraints. In the aspect give time they tend passive and less utilise time available. Lastly on the aspect push , tendency student not enough try in a way maximum and tend to fast feel satisfied with results the answer without inspection repeat . This is in line with results study related implementation approach *Realistic Mathematics Education* (RME) in increase ability *productive struggle* elementary school students show that approach This give impact positive to development ability breakdown problem mathematics students. One of the research by Saprizal (2018) found that use of RME in teaching mathematics increase skills student in finish problem mathematics in a way more independent and creative. This is supports the idea that RME encourages student For involved in *productive struggle*, namely face challenges that can Motivate they for work more hard in understand concepts mathematics.

CONCLUSION

Initial Design of Worksheet Student based on RME which has developed packed in digital form. Products End of Worksheet Student RME based on materials Smallest Federation Multiple that has developed Already revised based on recommendation repair design start on component design or layout, improvements to the layout and selection color on some page and scale as well as size necessary illustration considered. Improvement ability understanding draft mathematical after Worksheet implementation Student RME based is in the category currently.

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