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The Development of Independent Learning Through Brain Based Learning Assistance to Improve Grit and Mathematical Connection Ability

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Abstract

Low ability of mathematical connections affected by the lack of independence of students. Alternatives that can be used is using independent learning through mentoring using module based Brain Based Learning with grit character. The purpose of the research was to describe the module based Brain Based Learning and advisory guide category valid, the independent learning with assistance which was effectively improve the ability of mathematical connections, and describe the mathematical connection capability in terms of grit. The development stage modules using the procedures of Borg & Gall. The research was conducted at SDN 1 Manggungsari with sixth grade students as an experimental class. The analysis of the data used was the normality test, completeness, regression testing and test Gain. The results showed that Modules and advisory guide category was valid with the same score of 4.1; Self-regulated learning with assistance was effectively improve the mathematical connection, there is an increase of 0.53 at medium category, and 62.2% gave a positive response; Overall, student with high grit was able to understand the mathematical connection capability indicator. It can be concluded that self-assisted learning modules based Brain Based Learning with grit character can enhance the ability of the mathematical connections.

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INTRODUCTION

Learning of mathematics in primary and secondary aims to emphasis on reasoning structuring and formation of students' attitudes and skills of application of mathematics in everyday life and in helping others learn science. Kline (Rohendi & Dulpaja, 2013) stated that mathematics is not an autonomous knowledge that can be perfect by itself, but primarily to help people in understanding and mastering the problems of social, economic, and natural. Flowers, Atun, & Julia (2016) stated that the study of mathematics is always associate the concept with other concepts, so that the necessary mathematical connection. It can be deduced that one of the most important capabilities of mathematics education is the ability of mathematical connections.

Based on the interviews with sixth grade teacher at SDN 1 Manggungsari, average it was found that score of Odd Middle Semester Exam Academic Year 2017/2018 math is low. Observations shown that students answer sheets are still difficult to understand and associate the concept of material about fractions. A report published by UNESCO (2010) related to the findings of the NCTM in 2007 stated that students around the world had difficulty in learning fractions. Jaky (2015) also stated similar things about the statement.

The results of the interview with three sixth grade students, it was found that they experience difficulty in fractions material related to mathematical connection though matter has been directed at everyday life. Sulistyaningsih's research (2012) states that in general the ability of students in mathematical connections is still low. Based on the interview to two guardians, students have study time at home but have not been able to manage study time and yet have independent learning.

From the observation results, it can be concluded that the low ability of fraction mathematical connections is caused by several factors namely teacher-centered learning. Teachers rarely control study independently. Interest in learning, toughness, and low student independence cause weak in mathematical connection capabilities material fractions.

Sixth grade math fractions material the required perseverance and independence of learning which insisted on the importance of character formation. Hasratuddin (2013) states the character is a behavior that has been ingrained and be spontaneous human response in addressing the incident. Appropriate positive character of student that is important to be trained is grit.

Formation grit learner difficult to emerge without independence. Lawrence (2014) states independent learning can be defined as an individual effort for learning activities alone or with the help of others based on their own motivations for mastering the material and or the specific competencies that can be used to obtain satisfactory academic results.

Modules can make students learn independently so as to support the role of the teacher in the learning process (Barata, Zaenuri, Sukestiyarno, 2019). The module is designed and arranged systematically to organize student learning that allows students menguasari one unit of the subject matter before switching to the next unit (Maliya, Isnarto, Sukestiyarno, 2019).

Hidayati & Listyani (2010) formulated the six indicators of independence of student learning: (1) independence against others; (2) have the confidence; (3) behaves discipline; (4) have a sense of responsibility; (5) act on its own initiative; and (6) exercise self-control.

One design modules that can be applied to the students of class VI material-based learning model fractions namely Brain Based Learning associated with the brain's ability to consider what natural character for our brain and how the brain is affected by environment and experience (Jensen, 2008). In the self-learning through the module students have the opportunity to explore seeking information regarding the material learned either to parents, peers or from other sources.

The translation of explaining learners still need some assistance. Kamil (2010) argues that mentoring is an activity that is carried out by someone who is consultative, interactive,

communicative, motivating, and of negotiated. Mentoring is done programmatically through face to face or on social networks to facilitate students find difficulty at the time when the self-learning. Based on the problems described it is important to do research through independent learning with mentoring Brain Based Learning with grit character contained based modules to improve mathematical connection material fractions.

METHODS

This research uses a combination of research (mixed method) with concurrent types of embedded design with the materials used in the self-study is based modules Brain Based Learning characterized grit and mentoring guidance through validity test. Test the effectiveness of self-study using a combination of sequential design method of embedded design. Research implemented in SD Negeri 1 Manggungsari class VI semester 2018/2019 academic year as an experimental class.

Data collection instruments used include sheet module validation, validation guidelines for self-study, questionnaire responses of teachers, questionnaire responses of learners, interview, guidance scoring connection capability mathematically, sheet validation questionnaire responses of teachers, sheet validation questionnaire responses of learners, sheet validation guidelines interview and validation sheet scoring guidelines mathematical connection capabilities. The results of students' cognitive abilities measured by tests of mathematical connections. Problem test conducted feasibility test with validity, reliability, level of difficulty and distinguishing features.

RESULTS AND DISCUSSION

The test is done to the six graders to determine the students' response to the grit charged module-based Brain Based Learning and mentoring guide that r esearchers develop independent learning. Data assessment and validation namely by media experts, subject matter experts, teachers, and students' test results are presented in Figure 1.

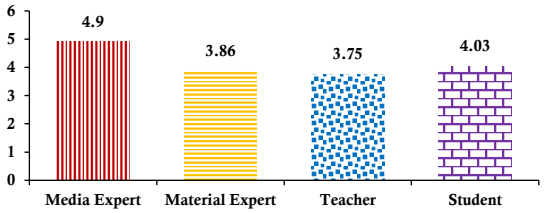

Figure 1. Assessment Score by Expert Media, Content Expert, Teacher, and Student Testing

As seen in Figure 1, the highest score obtained from media experts with a score of 4.9. Obtaining the second highest score obtained from students with a score of 4.03 and the next highest score of 3.86 was obtained from subject matter experts and teachers with a score of 3.86. The overall average score is 4.1 with a percentage of 87% categorized as valid. The test is then performed on self-learning advisory guidelines. The data of the results of the assessment and validation by experts, teachers and students trials is presented in the following Figure 2.

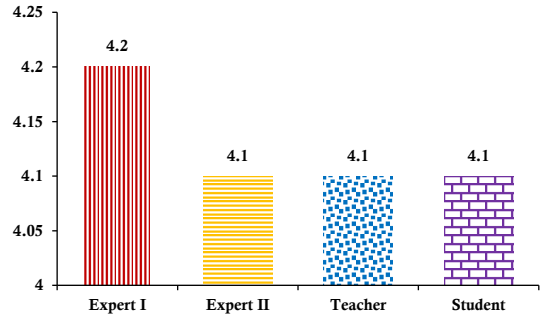

Figure 2. Assessment Score by Expert, Teacher, and Student Testing

Based on Figure 2 obtained the highest score from experts I of 4.2. Obtaining the next highest score obtained from a third appraiser II, namely by experts, teachers and students with the same score each is 4.1. Overall validation of mentoring guidelines obtained an average score of 4.1 with a percentage of 87% which categorized as valid.

Independent learning through mentoring assistance implemented through stage 5 times face to face meeting. Scenario research is given

module before the material taught in class VI. Students learn to independently use the module. When the use of modules, students can conduct group discussions and seek information from various sources about the material that has not been understood. On-face mentoring researchers provide opportunities and facilitate student when encountering difficulties in independent study. Based on the findings of independent learning observations obtained data which can be seen in the following Figure 1.

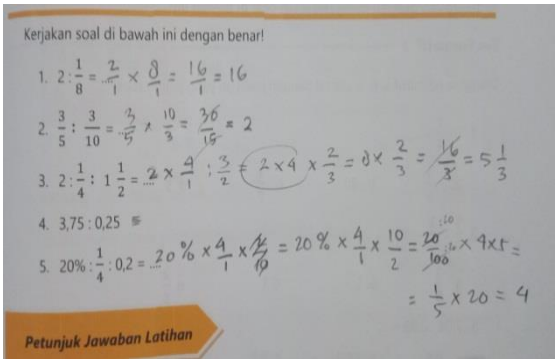

Figure 1. Result of the Student Work in the Independent Learning

In Figure 1, it can be seen that students work on the exercises in the module independently. In the indicator of the relationship between the concepts of fractions, students were able to solve problems well, even though there was one problem that could not be completed. This shows the existence of motivation and effort in the independence of student learning.

The next step was posttest of mathematical connection capabilities, Data posttest results tested normality test done first before the thoroughness and test improvement. Analysis of individual mastery test mathematical connection capability using the test one hand, obtained significant value 0,036 less than significant level of 5%, which means an average student reached better than before.

The assessment stage was the stage of measuring the mathematical connection ability. The mathematical connection ability of students at the assessment stage was seen from the results of the mathematical connection ability test. The results of the pre and post of the mathematical connection ability tests can be seen in Table 1.

Table 1. Result of the Pre and Post of Mathematical Connection Ability Test.

Aspects	Score of Pretest	Score of Posttest
Average score	51.35	77.5
Maximum score	88	94
Minimum score	18	46

Table 1 shows that the average score of the mathematical connection ability of the pretest experiment class is still low. The average score of the post-test of the experimental class after obtaining the independent learning was 77.5. The class average is better than the average in the pretest of the mathematical connection ability.

The maximum value of the posttest of the experimental class is 94 and the minimum value is 46 with better results than the pretest. This shows that there is existence of indicators of the learning independence through independent learning using a module based on Brain Based Learning.

Analysis of the influence of grit against posttest using simple regression obtained significant value 0.000 less than significant level of 5%. It means that there is a positive influence between grit with mathematical connection capability in the experimental class after application of independent learning through mentoring. Improvement of mathematical connection abilityof student after using the module were analyzed by using N-gain test.

Based on the results of calculation of the index as much as 96.5% gain obtained experimental class students has increased and 3.5% decline. Data from the gain index calculation can be seen in Figure 3.

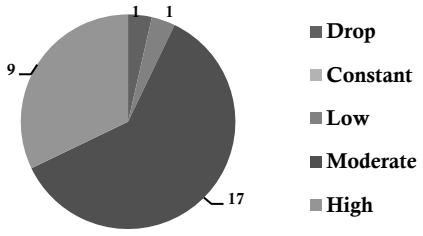

Figure 3. Calculation Results Gain Index

Figure 3 is 1 students has decreased, there are no students who are in the permanent category, one student at a low category, 17 students in the medium category, and 9 students in the high category. Measurement grit character using a questionnaire. Grit character questionnaire contains 30 statements, divided into 19 statements positive and 11 negative statements. Summary of grit character classification the experimental class students can be seen in Figure 4.

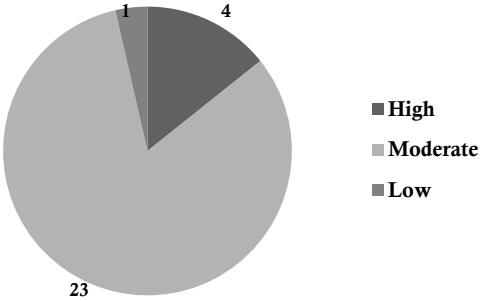

Figure 4. Recapitulation of Grit Character Classification in Experiments Class

Figure 4 shows at most that the achievements of the 19 students with a percentage of 68% in the moderate category. In the high category achieved by 8 students with a percentage of 29% and low category achieved by 1 students with a percentage of 3%. The classification aims to select the research subjects representing each category will be further investigated.

Researchers took six students as research subjects to be analyzed connection capabilities. The selected research subjects that respondents S10 and S21 to represent the high category, respondents S05 and S11 to represent the medium category, and respondents S23 and S28 to represent the lower category.

Analysis of the mathematical connection capability by high grit characters S10 and S21 on indicators mathematical concept understanding among students (C1) is able to associate the category of high grit mathematical concepts correctly and is able to use multiplication of fractions per cent in the long search for a square. Subject S10 and S21 is able to calculate the area using the decimal fraction multiplication correctly and is able to tie the formula area of a circle using a fractional percentage operating properly.

Students high on indicators grit understand mathematical relationships with daily life (C2) is able to use the concept of fractions mixture in determining the water flow with the result of the correct answer and were able to use a mixture percent fractional operation to determine the total price of honey purchased properly.

In the indicator to understand the relationship of mathematics with other subjects (C3) high grit students were able to use fractions associated with the percentage of the amount of voting power so that the number of valid voice said. Students are also able to determine the time and distance covered during the sprint using multiplication percentage and decimals correctly. In general, students with high grit able to solve the problems of mathematical connection capabilities.

Students category grit of S05 on the mathematical concept of linking indicators (C1) S05 is quite able to understand and associate the concept of existing problems in a matter of using the formula area of a circle and being able to count using fractional multiplication correctly. Subject S05 was able to associate a concept that exists in the search for a square side length, however, in the settlement have not been able to determine the result of multiplying fractions work properly.

Subject S05 indicator to understand the relationship of mathematics to understand the daily life (C2) is able to use way search for water discharge, but has not been able to use the concept of fractional multiplication mix properly. Subject S05 is able to understand the mathematical concept of calculating the price of two bottles of honey and discounts are subject to come by but in the completion of S05 still wrong in calculating the final result.

Subject S05 on indicators to understand the relationship of mathematics with other subjects (C3) is able to use fractions in calculating the number of members who attend meetings and counting the number of valid voting power properly. Subject S05 is able to associate a concept that exists in resolving problems related

to other subjects. Subject S05 is able to use multiplication percentage in determining the distance and the time taken to sprint properly.

Students category grit S11 on the mathematical concept of linking indicators (C1) to connect between the existing concepts in finding the area of a circle, but the subject has not been able to finish counting S11 fractions correctly. Subject S11 is able to associate a concept that exists in the search for a square side length, but still wrong in determining the outcome of work completion fractional multiplication.

Subject S11 indicator to understand the relationship of mathematics to understand the daily life (C2) able to connect the fractional multiplication in the search for water discharge, but the calculation is less precise S11, so that control of the S11 less than the maximum. Subject S11 is capable of connecting fragments in determining the price of two bottles of honey using the correct steps in the process, but less accurate in calculating the fractional operation.

Subject S11 on indicators to understand the relationship of mathematics with other subjects (C3) is able to connect multiplying fractions in calculating the number of votes of the members present and determine the number of valid voting power in social science. Subject S11 is capable of connecting fragments in determining the distance and time taken a race.

S23 Subject to the analysis of low grit mathematical connection capabilities on a mathematical concept understanding among the indicators (C1) is capable of understanding and correlating fractional multiplication to find the area of a circle. S23 subject quite capable of linking multiplication of fractions to search long square side, but still weak in the multiplication calculating fractions.

Subject S23 indicator to understand the relationship of mathematics to understand the daily life (C2) is quite capable of linking multiplication of fractions in the search for water discharge, but wrong in the calculation of fractions so the end result is less value. Subject S23 has been unable to connect fractions in determining the price of two bottles of honey using the steps right, but the less scrupulous in calculating the fractional operation.

Subject S23 on indicators to understand the relationship of mathematics with other subjects (C3) has not been able to connect multiplying fractions in calculating the number of votes of the members present and determine the number of valid voting power. Subject S23 also not been able to connect the fragments to determine the distance and time taken a race.

Students low grit category S28 on the mathematical concept of linking indicators (C1) has been able to write what they know and ask about, is able to associate the concept by writing a circle formula, but the subject S28 looks origin in the calculation of the final result. Subject S28 has been able to write information on the matter and correct the formula to write square area, but have not been able to link the fractional multiplication problems in finding the long sides of a square.

Subject S28 on indicators to understand the relationship of mathematics to everyday life (C2) has not been able to connect the fractional multiplication in the search for water discharge, in writing formula to find the origin of water discharge, and miscalculations in the multiplication of fractions. Subject S28 has not been able to connect the chips to determine the price of two bottles of honey used, and the origin in the writing of the correct steps.

Subject S28 on indicators to understand the relationship of mathematics with other subjects (C3) enough to be able to write what they know and ask the question, capable of connecting the chips to find the number of voting power, but has not been able to resolve the issue and any related problems in the calculation. the subject has not been able to connect fractional S28 and origin in determining the formula to find the distance and time of the race.

The results of data analysis can be concluded that the module-based Brain Based Learning charged grit and mentoring guidelines for independent learning that The highest ratings on the module obtained from media experts with a score of 4.9. Obtaining the second highest score by a student with a score of 4.03. The next highest

score of 3.86 matter experts, and teachers with the same, namely 3.75. The average results of the validation module by media experts, subject matter experts, teachers, and testing students is 4.1 with a percentage of 87% categorized as valid.

Guidelines for independent learning assistance that researchers have developed overall had an average score of 4.1 with a percentage of 87% categorized as valid. The details of the validation sequence score the highest score validator I with a score of 4.2. The next highest score by a validator II, teachers, and students with the same score is 4.1 with a percentage of 87% categorized as valid.

Amalia (2016) in her research indicates that assessment module of experts on social arithmetic material concept, the concept of multi-level, the formation of entrepreneurial spirit, and the appearance and readability of each 80% said good condition and valid criteria. Khoirotunnafi'ah (2017) suggests results-based math learning module development activities which Islamic nuances critical to get the value of valid of third validator. Based on the results of this study concluded that based modules Brain Based Learning charged grit and self-study guide assistance categorized as valid from both validators, teacher, and student testing.

Implementation of self-learning with effective assistance to the mathematical connection capabilities. The results showed that, there is an increase of 0.53 in the medium category, and give a positive response to their own learning by 62.2%.

Research conducted Handayani, Nyoman and Wayan (2013) suggests that first, independent learning among students who take the self-learning model was significantly better than students who follow conventional teaching (F of 36.028 and $p < 0.05$). Second, science learning achievement between students who take the self-learning model was significantly better than students who follow conventional teaching (F of 29.537 and $p < 0.05$). Third, simultaneously independent learning and learning achievement between students who take the self-learning model was significantly better than students who follow conventional teaching (F amounted to 34.48 and $p < 0.05$). Learning self by mentoring motivate students to learn and provides the opportunity to explore independently understand the problems related to Fractional material mathematical connection ability.

In the mathematical concept of linking indicators (C1), to understand the relationship of mathematics to everyday life (C2), and understand the relationship of mathematics to other subjects (C3) high grit category students able to resolve the problems associated with good mathematical connection. Students category grit was quite capable of resolving issues related to the mathematical connection, but still weak in understanding mathematical relationships with other subjects. Students category of low grit generally weak in solving problems related to mathematical connections. In line with research conducted Fatin (2019) that the effect of growth mindset on school well-being of senior high school students in Purbalingga was mediated by grit.

CONCLUSION

Based on the results of research and discussion, it can be concluded. Module charged grit based Brain Based Learning and guidelines assisting independent learning in a valid criteria. The application of independent learning with the assistance module using a charged grit based Brain Based Learning effectively improve the ability to connect mathematical. In student's overall high grit and being able to master the mathematical connection capability indicator.

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