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DEVELOPING MULTIPLE INTELLIGENCE-BASED NATURAL SCIENCE LEARNING MODULE TO IMPROVE ELEMENTARY SCHOOL STUDENTS' HIGHER ORDER THINKING SKILLS

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Abstract: This study aims to develop a valid and effective natural science learning module based on multiple intelligences to improve high-level thinking skills of elementary school students. The type of research used was development research (R & D) which refers to the ADDIE, Dick and Carry models. A questionnaire sheet was used as instrument, consisting of 4 aspects, namely the feasibility of material, language, design, and media, as well as teacher and student response questionnaires. Based on the study, the results of the feasibility test by material experts obtained the feasibility of the product with a very good category, the feasibility test by a linguist with the product eligibility resulted in the very good category, the product feasibility test resulted by design experts were in the very good category, the feasibility test for the learning media expert was good, and the results of teacher and student assessments were in very good category. Furthermore, the results of the product truth test to students through the pretest and posttest showed that the products can improve student learning outcomes. From the calculation of the hypothesis test carried out, the significance results obtained were 0.00 <0.05, meaning that there were differences in student learning outcomes before and after using the science learning module. Based on the results of the hypothesis test, it can be denied that the science learning module based on multiple intelligence can improve students' higher order thinking skills in elementary schools.
Keywords: *module; multiple intelligences; HOT.*

INTRODUCTION

Education is a process of stimulating all the potentials that students have in creating a learning environment in accordance with the potential characteristics of students. Furthermore, according to the *Undang-Undang Sistem Pendidikan Nasional* No. 20 Tahun 2003, "Education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, morals. noble, as well as the skills needed by himself, society, nation and State" (*Undang Undang Sisdiknas*, 2003).

This potential will be able to emerge and develop effectively through appropriate and integrated learning through balanced learning management by adjusting the development of students as a whole. One of the potentials possessed by students is multiple intelligence. Every intelligence in children will appear at a certain time according to its developmental stages (as stated by Piaget in Hermita, 2017), which is what occurs starting from the sensorimotor phase (0-2 years), the preoperational phase (2-7 years), the operation

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phase, concrete (7-12 years) to the formal operation phase (12 to adulthood). Through education, students can also interact with the environment to develop their abilities. These abilities can be in the form of cognitive abilities: namely honing knowledge, affective abilities: sharpening feelings of sensitivity, and psychomotor abilities: skills to do something. Through these three abilities, students are expected to be independent individuals who are ready to step into the world outside of school.

One of the most basic problems in the scope of our education is the weak learning process. Learning is a communication process involving teachers, students, and teaching materials. One of the potential teaching materials to be developed to transfer material in learning as an attraction for students' interest and motivation is a module. The advantages of modules include being able to learn without having to present a teacher, being able to learn independently, being able to study at any time, learning that can be adjusted to one's ability, learning to choose according to its own order (Ardianti, Wanabuliandari, Saptono, & Alimah, 2019).

According to Rofiah, Aminah, & Widha (2018), modules can be compiled and developed by the teacher in accordance with the needs and characteristics of students. Teachers as the forefront of education who are directly involved in classroom learning are required to have competence in using and developing teaching materials. Teachers should not only be able to develop modules limited to attracting and to increase students' motivation in science learning, but also be able to enhance and stimulate the emergence of multiple intelligences, and be able to increase students' higher order thinking skills.

The learning process that has occurred so far has not been able to develop Higher Order Thinking Skills or what is known as HOTS (high order thinking skills) of students. The implementation of the learning process that takes place in the classroom is only directed at students' ability to memorize information. The students' brains are forced to remember and store various information without understanding the information obtained in relating it to daily situation. This can be seen from students who only receive information abstractly, so they are unable to form the concept of the subject matter correctly. The teachers have not fully carried out active and creative learning in engaging students and have not used various strategies and learning resources that vary based on the character of the subject matter. In general, teachers are only fixated on textbooks as the only source of teaching and learning.

The development of teaching materials/modules of Natural Science based on multiple intelligence is very important to be developed as this concept facilitates all students who have various kinds of intelligence. Based on the concept of multiple intelligence from Howard Gardner, each individual is not patched based on high intelligence and low intelligence, but provides an overview of the eight types of intelligence, if each student is stimulated, facilitated and served well according to the concept of multiple intelligence with various type of intelligence so that students can grow and develop all their potential to the maximum (Gardner & Hatch, 1989). The concept of multiple intelligences has not been optimally integrated in every education in schools. The implementation of multiple intelligences can only be carried out partially in an educational environment and has not been handled professionally so it tends to ignore the fundamental aspects of multiple intelligences.

The study of the development of students' abilities based on multiple intelligences is expected to provide a new nuance of how human nature in terms of potential, talents, and abilities can be optimally developed, as well as providing opportunities for teachers and students from the start, especially regarding multiple intelligences, presumably can provide a strong motivation; that education and learning activities need to be studied more deeply, that the essence of the theory of multiple intelligences according to Gardner is to appreciate the uniqueness of each individual, the variety of learning methods, to create a number of models to assess them, and the almost limitless way to actualize oneself in this world. In fact, multiple intelligences exist in every individual, but each individual can have one or more multiple intelligences that have the highest level of multiple intelligences. However, in the practice of learning in schools, it is appropriate for a teacher to have data about the level of tendencies for each student's multiple intelligences (Amir, 2020).

The relationship between learning and multiple intelligences as stated by Ayesha & Khurshid (2013) that the results of the research are clearly analyzed and interpreted the data, revealing that multiple intelligence, learning

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skills, and academic achievement are interrelated constructs in the teaching and learning environment. Based on the research findings; multiple intelligence, study skills, and academic achievement are significantly positively correlated with each other.

The most important educational implications from the theory of multiple intelligences can be summed up through individuation and pluralization. Individuation posits that because each person differs from another, there is no logical reason to teach and assess students identically.

Individualized education has typically been reserved for the wealthy and others who could afford to hire tutors to address individual students' needs. Technology has now made it possible for more people to access variety of teachings and assessments depending on their needs. Pluralization, the idea that topics and skills should be taught in more than one way, activates individual's multiple intelligences (Marenus, 2020).

METHOD

The research objective was to develop a science learning module based on multiple intelligence to improve the research. The development model used was the ADDIE model, developed by Dick and Carry which has five steps, namely analysis, design, development, implementation, and evaluation (Branch & Dousay, 2015).

After being validated by material, language, student design, and learning media experts, with the criteria for the assessment criteria in table 1 as follows, the data analysis used in this research were descriptive qualitative and quantitative statistical analysis techniques. Qualitative data were obtained from the results of input and suggestions during field trial activities, while quantitative data were obtained from the results of surveys of experts, teachers and students. The questionnaire result data were obtained using a Likert scale with a scale of 5, namely; 1 = not good/irrelevant 2 = not good/not relevant, 3 = good enough/quite relevant, 4 = good/relevant, 5 = very good/very relevant. Based on the scale value, in order to determine the average value of the interval range from each aspect can be calculated by using the formula:

$$\text{Interval Scala (RS)} = \frac{m-n}{B}$$

RS = Interval Scale
m = The highest number in the answer score
n = The lowest number in the answer score
B = number of answer choices

Based on the calculation of the formula, it is then converted into a descriptive value as presented in table 1.

Table 1. *Interpretation of the scoring criteria*

Score Scale	Criteria
4.6 – 5	Very good
3.7 – 4.5	Good
2.8 – 3.6	Good enough
1.9 – 2.7	Less good
1 - 1.8	Not good

Furthermore, calculating the percentage of feasibility based on the data spanning the scale, the researcher determined the average of each validator by calculating each aspect assessed by using the following formula:

$$P = \frac{\sum X}{N} \times 100$$

P = Presentation of score for each criterion

$\sum X$ = the number of answers for each criterion

N= maximum score for each criterion

Based on the calculation of the formula, the values were then converted into feasibility data as in the following table:

Table 2. *Percentage of appropriateness scores*

Score Scale (%)	Worthiness level
81-100	Very worthy
61-80	Worthy
41-60	Worthy enough
21-40	Less worthy
0-20	Not worthy

From the results of the analysis of the assessment of the opinion of material experts, design experts, language experts, media experts, and teachers get a decent and very feasible category assessment, then the science module based on multiple intelligences can be used in the learning process. However, if the results of the expert opinion assessment do not yet meet the proper and very feasible criteria, the science based multiple intelligence module must be improved or revised until it meets the criteria so

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that it is suitable to be used by students and teachers.

RESULTS AND DISCUSSION

Data Validation Results

The results of validation by experts on the science learning module based on multiple intelligence include four components among others; aspects of material, language, learning design, and learning media. The results of the assessment by experts, the developed module is in the good category, with various suggestions and inputs to be improved and refined, the developed science learning module is suitable for use in the learning process. The results of the assessment by experts are presented in table 2.

Table 2. *Validation of science module by experts*

No.	Experts' Validation	Score
1	Material Expert	4.38
2	Linguist Expert	4.21
3	Design Expert	4.54
4	Media Expert	4.82

Teacher's Response to the Science Module

Data analysis of teacher's responses to the science learning module based on multiple intelligence using a questionnaire with Likert scale assessment (values 1 to 5) was analyzed descriptively then the value was converted into a standard score according to the rating scale. The results of the assessment of teacher's responses to the science learning module based on multiple intelligence can be seen in table 3 below:

Table 3. *Teacher's response to science module*

No.	Assessment Aspects	Average score
1	Content of the Material	3.70
2	Learning aspects	4.00
3	Design Aspects	4.25
4	Language Aspects	3.75
5	Illustration aspect	4.40
	Average	4.02

Based on the assessment of the teacher's response to the science learning module based on multiple intelligence, seen from the aspects of the material content, learning, design, language, illustrations, were categorized as good. For more details, the assessment of teacher's responses to the science learning module based on multiple intelligence can be seen in the form of a bar chart in Figure 1.

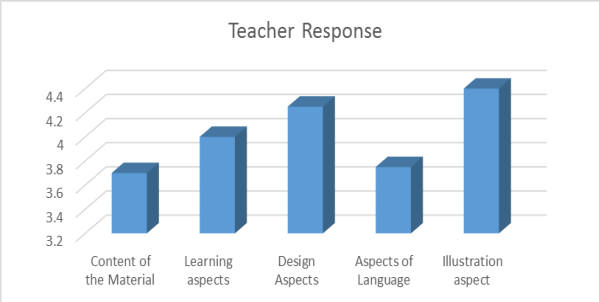

Figure 1. *Teacher's response*

The teacher's response to the module that has been developed is in the good category.

Students' Responses to The Science Module

The results of the data analysis of students' responses to the science learning module based on multiple intelligence using a questionnaire and Likert scale assessment (values 1 to 5) were analyzed descriptively and then the values were converted into standard scores according to the rating scale. The results of assessing students' responses to the science learning module based on multiple intelligence can be seen in table 4 below:

Table 4. *Students' responses to the science module*

No.	**Assessment Aspects**	**Average score**
1	Aspect Ease of Use	3.80
2	Aspects of the attractiveness	4.50
3	Benefits Aspects	4.04
	Average	4.11

Based on students' assessments of the dual intelligence-based science learning module from the aspect of using aspects of the attractiveness of offerings and aspects of benefits, it was categorized as good. This supports the opinion written on Gita, Annisa, & Nanna (2018) that the developed teaching material in the form of a science learning module has several advantages that will make students learn independently, be more active, and efficient in learning, and can visualize abstract objects, then can be used in the destination space so that it is easier to implement.

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An attractive presentation module becomes an attraction for readers, so it can increase knowledge for more clarity on student responsibilities towards multiple intelligence-based science learning modules which can be seen in the form of a bar chart in Figure 2.

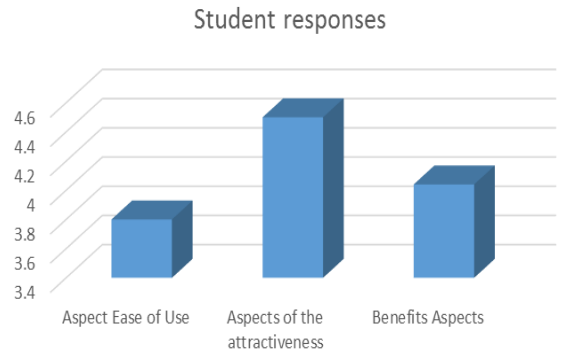

Figure 2. *Students' responses to the science module*

Students' responses to the module development results are in the good category, this is in line with the statement on Widya & Allmuddin (2018) that teaching materials or modules have an important position in learning and have an effective influence in increasing student activity and learning outcomes, because with materials good teaching can direct learning. Learning is more effective and makes it easier to achieve the desired learning goals.

Data on Learning Outcomes

Learning outcome assessment data is an evaluation of students' cognitive domains obtained after working on test questions and participating in teaching and learning activities using multiple intelligence-based science learning modules. Learning outcome data is presented in table 5.

Table 5. *Student learning outcomes*

Interval Score	Percentage before using the IPA module.	Percentage after using the IPA module
61-64	13.04	0.00
65-68	30.43	0.00
69-72	30.43	0.00
73-76	21.74	21.74
77-80	4.35	26.09
81-84	0	8.70
85-88	0	26.09
89-91	0	4.35
92-95	0	13.04

The minimum completeness criteria (KKM) set by the teacher was 75.00, based on the data presented in table 5 showing that the results of students' learning before using the science learning module based on multiple intelligence students who have reached the KKM were 26.09%, while students who have not reached the KKM were 73.90 %. Students' learning outcomes after using the science learning module that have not reached the KKM were 4.34% (1 student) while students who have reached the KKM were 95.65% (23 students).

a) Analysis of students' learning outcomes

The test questions used for the pre-test and post-test were 25 multiple choice questions. Based on the results of the pre-test and post-test learning outcomes using multiple intelligence-based science learning modules of 23 students of IV grade in SD Negeri Unggulan, the lowest pre-test score was 61 and the highest score was 77, while for the post-test score, the lowest score was 80 and the highest score was 95. From these results, it can be concluded that all students or 23 students have met the minimum completeness criteria, 75 score. From the comparison between the pretest and post-test scores, it can be seen that there was an increase in learning outcomes.

b) Analysis of the pretest and post-test data

The data from the pretest and post-test were calculated by using the paired sample t-test by using SPSS 22 for windows software to find out whether there are differences in learning outcomes before and after learning using multiple intelligence-based science modules.

1) Normality test

Normality test was used to determine whether the data was normally distributed or not the data to be analyzed. The normality test was used to test the data from the students' pretest and post-test results, the normality test used the Kolmogorov-Smirnov criteria. If the significance of the calculation results > 0.05, it can be

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concluded that the data is normally distributed can be seen in table.

Table 6. *Normality test*

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pre-test	.089	23	.200*	.975	23	.800
Post-test	.139	23	.200*	.934	23	.132

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the normality test output data, it shows that the significance value of the pretest 0.800 and post-test 0.132 was more than 0.05, it can be concluded that the two data are normally distributed.

2) Paired Samples Test

Paired Samples statistics can be seen in table 7.

Table 7. *Paired Samples Test*

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	69.74	23	4.372	.912
	Post-test	82.78	23	6.728	1.403

Based on the results of the paired average difference test, the average value of students' learning outcomes before using the multiple intelligence-based science learning module is 69.74, while the average value of learning outcomes after using the multiple intelligence-based science learning module is 82.78, meaning that the average result of students' learning has increased after using a science learning module based on multiple intelligence of 12.86.

3) Different test of the relationship between two pairs of samples

The relationship between learning outcomes before and after using the science learning module based on multiple intelligence can be seen in table 8.

Table 8. *Relationship between learning outcomes before and after using the science learning module*

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pretest & Post-test	23	.485	.019

Based on the test results, it shows that the correlation between the two variables are the r value of 0.485, which is higher than the r table which is 0.413, meaning that there is a significant and positive correlation between the two average values of learning outcomes before and after using the multiple intelligence-based science learning module.

4) Hypothesis Test

The hypothesis proposed were:

Ho: There is no difference in student learning outcomes after using a science learning module based on multiple intelligence.

H1: There are differences in student learning outcomes after using a science learning module based on multiple intelligence.

Table 9. *Hypothesis testing*

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest – Post-test	-13.043	5.988	1.249	-15.633	-10.454	-10.446	22	.000

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Based on the results of the hypothesis test, the t value was -10.446 with a significance of 0.00, because the significance value is lower (<0.05), it can be concluded that H1 is accepted, this indicated that there are differences in student learning outcomes before and after using multiple intelligence-based science learning modules.

CONCLUSION

The development of science teaching materials developed by the ADDIE Model researcher has 5 stages, namely the analysis, design, development, implementation, and evaluation stages. This HOTS-based science module development contains Competency Standards, Basic Competencies, and Indicators according to the theme of science learning. Each learning activity contains HOTS aspects such as analyzing, evaluating, and creating.

The science learning module developed in this study is appropriate and suitable for use in learning. The feasibility aspect of the content is in the good category, the material feasibility aspect is in the good category. The aspect of language eligibility is in the good category. The graphic aspect is in good category.

The science learning module developed in this study has been effectively used to improve student learning outcomes seen from the average value of students before and after using the science module. The average score of students after using the module is higher than the average score of students before using the science learning module.

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