Contextualized Modules in Physics for Junior High School Students

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ABSTRACT

Making instruction relevant to students is significant in the implementation of the K-12 curriculum. In response to the call to contextualize curriculum, this study developed and validated contextualized modules in physics for junior high school students through research and development methodology. It involved three phases: planning phase, development phase, and validation phase. The planning phase involved intensive review of science curriculum and contextualization of instruction, and identification of relevant materials and processes as tools for contextualization. The developmental stage involved writing the modules using the identified inputs and reviewed instructional design. In the validation phase, the contextualized modules in physics were validated by five experts in the field of physics education in terms of objectives, content, learning activities and evaluative activity. In the field testing, the 86 Grade 9 students of the UNP-Laboratory High School served as the respondents. The result showed 1) the contextualized modules in physics are "Very Much Valid", 2) the modular instruction group performed better in the posttest than the traditional lecture group, and 3) the modular instruction group improved their performance better than the traditional lecture group as shown in the normalized gain. It is concluded that the contextualized modules in physics are effective materials in improving students' achievement in physics.

Keywords: *contextualization, development and validation, instructional material*

INTRODUCTION

The most important frameworks in education, the six Education for All (EFA) goals and the eight Millennium Development Goals (MDGs), have shaped the education priorities of the United Nations Educational, Scientific and Cultural Education (UNESCO) and were adopted by the world's government since 2000. The adaptation by Philippines of these frameworks is manifested in the enhancement of its curriculum. Through the Enhanced Basic Education Act of 2013 (RA 10533), basic education curriculum is strengthened and expanded.

Contextualization is recognized by RA 10533 as one of the standards in developing the curriculum. It is generally defined as the integration of situations that are relevant to students in the process of instruction (Ambrose, Davis & Ziegler, 2013; Baker, et al., 2009). Variation on the implementation of contextualization occurs, even of it is solely founded on the constructivist view of learning in which students create meaning out of their learning, because it is a goal-dependent approach (Ambrose, Davis & Ziegler, 2013). Regardless of its type of implementation, contextualized instruction showed positive impact on students' understanding (Bilican, Cakiroglu, & Oztekin, 2015; Chu & Treagust, 2014; & Dolphin, 2009), and perception of science (González, et al., 2015).

Instructional material development is important in the implementation of contextualized instruction (Baker, et al., 2009). Textbooks, the primary instructional material used in schools, are comprehensive but could be irrelevant (Ambrose, Davis & Ziegler, 2013), and out of context (González, et al., 2015). Through instructional material development, the problem on the nature of textbooks which could possibly impede the implementation of contextualized instruction will be addressed.

On the other hand, instructional modules have been used to address several problems in teaching physics. Studies have shown that instructional modules are effective tools in 1) improving students' motivation to study physics (Jou, Chuang, & Wu, 2010), 2) preparing students to learn physics (Chen, Stelzer, & Gladding, 2010), 3) making physics lesson easy to acquire and understand (Auditor & Naval, 2014; Alias, Siraj, DeWitt, Attaran & Nordin, 2013), and 4) addressing physics students diversity (Alias & Siraj, 2012). On a specific note, Holubova (2013) found out that a module in physics designed with demonstrations and experiments anchored on real life situations develop students' interest in physics. Similarly, contextualized modules showed potential in improving teaching (Testa, Lombardi, Monroy & Sassi, 2011), and improving students' motivation (Vaino, Holbrook & Rannikmae, 2012). In line with contextualized instruction, contextualized instructional materials lead to improved performance of students in class (Bahtaji, 2015).

The implementation of K+12 curriculum calls for the contextualization of instruction and this comes with the challenge to develop relevant instructional materials that will enable students not just to master the curricular contents and competencies but also to foster positive attitude towards subjects in the curriculum. In response to the call, and given the fact that a school, regardless of its type, is responsible in giving quality education (Banez & Pardo, 2016), the researcher developed and validated a contextualized module in physics for junior high school students. Specifically, this research determined 1) the extent of validity of the contextualized module in terms of objectives, content, learning activities and evaluative activity; and 2) its effects in improving students' achievement in physics.

METHODOLOGY

This study employed research and development in contextualizing modules in physics. Kristanto, Mustaji and Mariono (2017) defined research and development as a methodology employed in developing and validating educational products. The research and development phases in this study are planning, development and validation. In the validation phase, specifically in the field testing, quasi-experimental design was employed. In this design, a group is randomly assigned as experimental group and control group, after which both groups take the pretest, the treatment is applied only to the experimental group, and both groups take the posttest (Creswell, 2014).

The planning phase involved intensive review of the present science curriculum, and the process of contextualization and instructional development. It primarily focused on the review of the learning competencies, performance and content standards, and suggested learning materials of the junior high school physics. It also focused on identifying relevant materials and processes as tools for contextualization. These were the major inputs in the development of the contextualized modules.

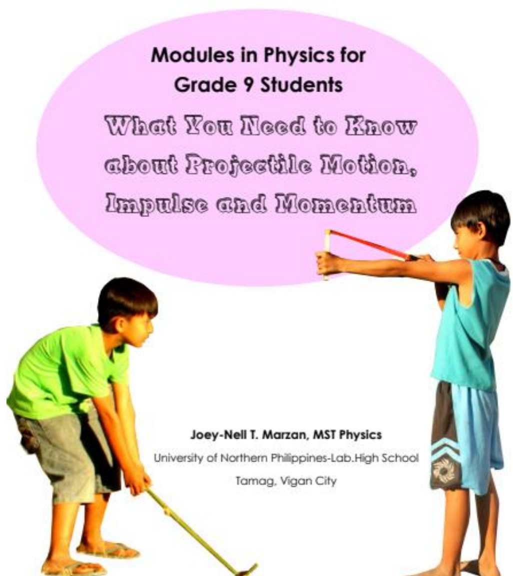
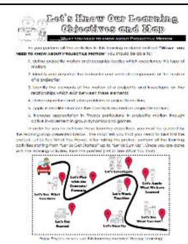
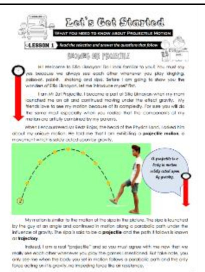
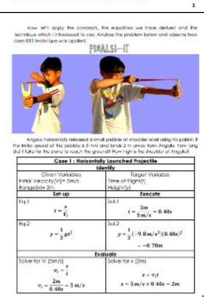
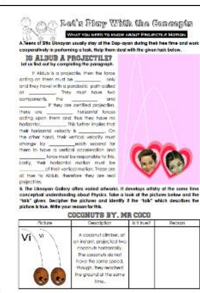
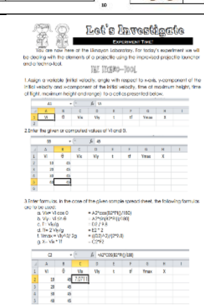


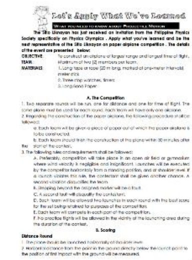
Figure 1. The Contextualized Module

On the other hand, the developmental stage involved writing the modules using the inputs and reviewed instructional design. There were two developed contextualized modules, namely Module 1: Projectile Motion and Module 2: Impulse and Momentum. The components of the contextualized modules are as follows:

Parts of the Module	Sample Page from the Section
1.Let's See What You Have This section aims to assess the initial knowledge of the students before taking the module. It is composed of multiple-choice items.	
2.Let's be Acquainted with Our Learning Objectives and Map This part of the module orients the students about what is expected from them right after taking the module. This also offers a guide for the learners to follow in order to achieve the set learning objectives.	
3.Let's Get Started This section gives the learner fundamental concepts through conversational presentation. Explanations and illustrative examples of the concepts are explained using indigenous games.	 
4. Let's Play with the Concepts/Formulas This offers activities that deepen students understanding on the fundamental concepts. Situations in popular TV shows, and emerging and indigenous games are used in the activities.	 
5.Let's Investigate This section requires students to perform experiments to validate the concepts they have learned in the previous sections of the module.	

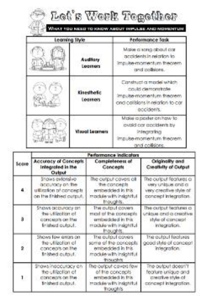
6. Let's Apply What We've Learned

This section offers game-based approach in applying the concepts learned by the students from the experiment and other learning activities they have performed.



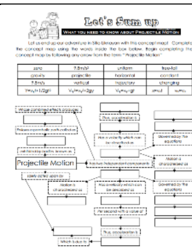
7.Let's Work Together

This section initiates group dynamics. Each group is required to submit a product based on the task given to them with respect to the type of learning style they have.



8. Let's Sum up

The students are required to complete a given concept map which gives a summary of the concepts presented in the module.



9.Let's See What You Got

This section aims to assess the initial knowledge of the students after taking the module. It is composed of multiple-choice items.

Lastly, in the validation stage, the contextualized modules were subjected to validation through content validation and field testing. In the content validation, five experts were chosen using two criteria – 1) holder of master's degree in physics teaching, and 2) have experience in high school teaching, evaluated the contextualized modules using a rating scale. The rating scale, a 16-item instrument which measures the validity of the module in terms of objectives, content, learning activities and evaluative activity, was adapted from the study of Alabaso (2012). The data gathered in this phase were analyzed using mean and Aiken's V.

After the content validation, the contextualized modules were modified by considering the comments and suggestions of the evaluators. This was followed by field testing which was conducted at the University of Northern Philippines-

Laboratory High School during the School Year 2015-2016. A section composed of 49 students served as the experimental/modular instruction group while another section composed of 37 students served as the control/traditional lecture group. The two groups were subjected to pretest first. The experimental/modular instruction group was exposed to modular instruction using the developed contextualized modules while the control/traditional lecture group was exposed to lecture method. A 40-item teacher-made test, which was subjected to content validity and pilot testing, served as the pretest-posttest instrument. The data gathered in the field testing were analyzed using frequency and percentage, mean, standard deviation, t-test and normalized gain.

In the conduct of the study, the researcher obtained full consent from the participants before the implementation of any research-related undertaking. The protection of the privacy of research participants and adequate level of confidentiality of the research data were ensured. Also, the research participants were not subjected to any harm. They avoided conflict of interest. Lastly, any type of communication about the research was done with honesty and transparency.

RESULTS AND DISCUSION

Extent of Validity of the Contextualized Modules

Five experts in the field of physics education were asked to evaluate the contextualized modules to determine the extent of validity of the instructional material in terms of objectives, content, learning activities and evaluative activity. Table 1 presents the summary of evaluation of the contextualized modules.

The evaluators rated Module 1 (Projectile Motion) as “Very Highly Attained” in terms of objectives, “Very Much Valid” in terms of content and “Very Much Appropriate” in terms of learning activities and evaluative activity. For the overall, Module 1 is described as “Very Much Valid”. While Module 2 (Impulse and Momentum) is rated as “Very Highly Attained” in terms of objectives, “Very Much Valid” in terms of content and “Very Much Appropriate” in terms of learning activities and evaluative activity. For the overall evaluation, Module 2 is described as “Very Much Valid”.

The overall evaluation shows that the contextualized modules are rated “Very Highly Attained” in terms of objectives, “Very Much Valid” in terms of content and Very Much Appropriate” in terms of learning activities and evaluative activity. As a whole, the contextualized modules are described as “Very Much Valid”. This implies that evaluators perceived that the contextualized modules in physics could really improve students’ understanding on physics particularly on projectile motion, impulse and momentum.

Table 1
Summary of the validators' evaluation on the contextualized modules in physics

Category	Projectile Motion			Impulse and Momentum			Overall		
	Mean	DR	Aiken's V	Mean	DR	Aiken's V	Mean	DR	Aiken's V
Objectives	5.00	VHA	1.00	4.90	VHA	0.98	4.95	VHA	0.99
Content	4.60	VMV	0.90	4.55	VMV	0.89	4.58	VMV	0.89
Learning Activity	4.64	VMA	0.91	4.60	VMA	0.90	4.62	VMA	0.91
Evaluative Activity	4.80	VMA	0.95	4.72	VMA	0.93	4.76	VMA	0.94
Overall	4.76	VMV	0.94	4.69	VMV	0.92	4.73	VMV	0.93

Norm:

Overall Evaluation		Objectives		Content		Learning and Evaluation Act.	
Range	Descriptive Interpretation	Range	Descriptive Interpretation	Range	Descriptive Interpretation	Range	Descriptive Interpretation
4.21-5.00	Very Much Valid	4.21-5.00	Very Highly Attained	4.21-5.00	Very Much Valid	4.21-5.00	Very Much Appropriate
3.41-4.20	Much Valid	3.41-4.20	Highly Attained	3.41-4.20	Much Valid	3.41-4.20	Much Appropriate
2.61-3.40	Valid	2.61-3.40	Attained	2.61-3.40	Valid	2.61-3.40	Attained
1.81-2.60	Not So Much Valid	1.81-2.60	Not So Much Attained	1.81-2.60	Not So Much Valid	1.81-2.60	Not So Much Attained
1.00-1.80	Not Valid	1.00-1.80	Not Attained	1.00-1.80	Not Valid	1.00-1.80	Not Attained

To further identify the extent of validity of the contextualized modules, Aiken's V for each category was computed. Aiken's V with 0.80 indicates good content validity of the measure (Kowsalya et al. 2012). The calculated values show that the contextualized modules are valid as implied on the V-value of each category which is all higher than 0.80.

Effects of the Contextualized Module in Students' Achievement

Before administering the treatment, that is, the use of the developed modules, a pretest was given to the two groups.

Tables 2 and 3 present the summary of the pretest results and mean scores of the modular instruction and traditional lecture groups.

In the pretest, majority of the students in both modular instruction and traditional lecture groups performed at "Fairly Satisfactory" level while majority of the students were at "Needs Improvement" level in projectile motion and at "Fairly Satisfactory" level in impulse and momentum.

Table 3 presents the summary of the pretest mean scores of the modular instruction and traditional lecture groups.

Table 2
Summary of the frequency distribution of the pretest results of the modular instruction and traditional lecture groups

Level	Modular Instruction Group						Traditional Lecture Group					
	Projectile Motion		Impulse and Momentum		As a Whole		Projectile Motion		Impulse and Momentum		As a Whole	
	f	%	f	%	f	%	f	%	f	%	f	%
Satisfactory	1	2.44	11	26.83	2	4.88	0	0	6	16.22	1	2.70
Fairly Satisfactory	15	36.59	22	53.66	28	68.29	18	48.65	17	45.95	22	59.46
Needs Improvement	25	60.98	8	19.51	11	26.83	19	51.35	14	37.84	14	37.84
Total	41	100	41	100	41	100	37	100	37	100	37	100

Based on the set norm for interpretation, the modular instruction group was rated "Needs Improvement" in the pretest performance on projectile motion and "Fairly Satisfactory" in impulse and momentum while the traditional lecture group was rated "Fairly Satisfactory" in the pretest performance both on projectile motion and impulse and momentum. As a whole, the two groups were rated "Fairly Satisfactory" in their pretest performance.

Table 4 presents the result of the t-test for the pretest mean scores between the modular instruction and traditional lecture groups. In projectile motion, impulse and momentum, and as a whole, the p-value is greater than .05. These imply that the difference in the pretest mean scores between the modular instruction and

Table 3
Summary of the pretest mean scores of the modular instruction and traditional lecture groups

Topic	Group	Mean	Descriptive Rating	SD
Projectile motion	Modular Instruction	3.98	Needs Improvement	1.92
	Traditional Lecture	4.19	Fairly Satisfactory	2.27
Impulse and Momentum	Modular Instruction	6.68	Fairly Satisfactory	2.63
	Traditional Lecture	5.70	Fairly Satisfactory	2.78
As a Whole	Modular Instruction	10.66	Fairly Satisfactory	3.10
	Traditional Lecture	9.89	Fairly Satisfactory	3.25

Norm:

Range	Descriptive Interpretation	Range	Descriptive Interpretation
17-20	Outstanding	33-40	Outstanding
13-16	Very Satisfactory	25-32	Very Satisfactory
9-12	Satisfactory	17-24	Satisfactory
5-8	Fairly Satisfactory	9-16	Fairly Satisfactory
0-4	Needs Improvement	0-8	Needs Improvement

Table 4
Summary of the t-test for the pretest mean scores between the modular instruction and traditional lecture groups

Topic	Mean: Modular Instruction Group	Mean: Traditional Lecture Group	t	p-value	Decision
Projectile motion	3.98	4.19	-0.45	.66	Do not reject H_o
Impulse and Momentum	6.68	5.70	1.60	.11	Do not reject H_o
As a Whole	10.66	9.89	1.06	.29	Do not reject H_o

traditional lecture group is insignificant. This further shows that the modular instruction and traditional lecture groups were initially at the same level of knowledge in physics particularly on projectile motion, impulse and momentum and are therefore comparable.

When the modular instruction and traditional lecture groups were done with the topics on Grade 9 Physics particularly on projectile motion, impulse and momentum, a posttest was administered to the two groups.

Tables 5 and 6 present the summary of the posttest results and mean scores of the modular instruction and traditional lecture groups.

In the posttest, majority of the students in the modular instruction group performed at “Very Satisfactory” level while majority of the students in the traditional lecture group performed at “Satisfactory” level. Taking it singly, in projectile motion, majority of the students under modular instruction group were

Table 5
Summary of the frequency distribution of the posttest results of the modular instruction and traditional lecture groups

Level	Modular Instruction Group						Traditional Lecture Group					
	Projectile Motion		Impulse and Momentum		As a Whole		Projectile Motion		Impulse and Momentum		As a Whole	
	f	%	f	%	f	%	f	%	f	%	f	%
Outstanding	3	7.32	8	19.51	2	4.88	0	0	1	2.70	0	0
Very Satisfactory	14	34.15	26	63.41	29	70.73	4	10.81	11	29.73	4	10.81
Satisfactory	19	46.34	5	12.20	10	24.39	14	37.84	14	37.84	20	54.05
Fairly Satisfactory	5	12.20	2	4.88	0	0	16	43.24	9	24.32	13	35.14
Needs Improvement	0	0	0	0	0	0	3	8.11	2	5.41	0	0
Total	41	100	41	100	41	100	37	100	37	100	37	100

Table 6
Summary of the posttest mean scores of the modular instruction and traditional lecture groups

Topic	Group	Mean	Descriptive Rating	SD
Projectile motion	Modular Instruction	11.66	Satisfactory	2.95
	Traditional Lecture	8.59	Satisfactory	2.92
Impulse and Momentum	Modular Instruction	14.73	Very Satisfactory	2.59
	Traditional Lecture	10.51	Satisfactory	3.59
As a Whole	Modular Instruction	26.39	Very Satisfactory	4.34
	Traditional Lecture	19.11	Satisfactory	5.27

Norm*:*

Range	Descriptive Interpretation	Range	Descriptive Interpretation
17-20	Outstanding	33-40	Outstanding
13-16	Very Satisfactory	25-32	Very Satisfactory
9-12	Satisfactory	17-24	Satisfactory
5-8	Fairly Satisfactory	9-16	Fairly Satisfactory
0-4	Needs Improvement	0-8	Needs Improvement

at “Satisfactory” level while majority of the students under the traditional lecture group were at “Fairly Satisfactory” level. In impulse and momentum, majority of the students under modular instruction group were at “Very Satisfactory” level while majority of the students under traditional lecture group were at “Satisfactory” level.

Table 6 presents the summary of the posttest mean scores of the modular instruction and traditional lecture groups.

The modular instruction group was rated “Satisfactory” in projectile motion while “Very satisfactory” in impulse and momentum. There is an improvement in the performance of the modular instruction group from “Very Poor” to “Satisfactory” in projectile motion and “Poor” to “Very Satisfactory” in impulse and momentum. As a whole, the modular instruction group improved from “Poor” to “Very Satisfactory”.

On the other hand, the traditional lecture group was rated “Satisfactory” both in projectile motion and in impulse and momentum. There is an improvement of the traditional lecture group from “Poor” to “Satisfactory” in projectile motion and in impulse and momentum. As a whole, the traditional lecture group improved from “Poor” to “Satisfactory”.

Table 7
Summary of the t-test for the posttest mean scores between the modular instruction and traditional lecture groups

Topic	Mean		t	p-value	Decision
	Modular Instruction Group	Traditional Lecture Group			
Projectile motion	11.66	8.59	4.60	.000	Reject H_o
Impulse and Momentum	14.73	10.51	5.90	.000	Reject H_o
As a Whole	26.39	19.11	6.62	.000	Reject H_o

The posttest mean scores of the modular instruction group are higher compared to the traditional lecture group in projectile motion, in impulse and momentum and as a whole. This finding is parallel to the finding of Auditor and Naval (2014) that the modular instruction group has a higher posttest score than the traditional lecture group.

Table 7 presents the result of the t-test for the posttest mean scores between the modular instruction and traditional lecture group. In projectile motion impulse and momentum and as a whole, the p-value is less than .05. These imply

Table 8
Summary of the frequency distribution of the normalized gain of the modular instruction and traditional lecture groups

Level	Modular Instruction Group						Traditional Lecture Group					
	Projectile Motion		Impulse and Momentum		As a Whole		Projectile Motion		Impulse and Momentum		As a Whole	
	f	%	f	%	f	%	f	%	f	%	F	%
High Gain	5	12.20	20	48.78	7	17.07	0	0	3	8.11	0	0
Medium gain	28	68.29	21	51.22	32	78.05	15	40.54	20	54.05	17	45.95
Low Gain	8	19.51	0	0	2	4.88	18	48.65	10	27.03	19	51.35
No Gain	0	0	0	0	0	0	4	10.81	4	10.81	1	2.70
Total	41	100	41	100	41	100	37	100	37	100	37	100
Mean	0.47		0.69		0.53		0.27		0.33		0.31	
DR	Medium Gain		Medium Gain		Medium Gain		Low Gain		Medium Gain		Medium Gain	
SD	0.19		0.15		0.14		0.17		0.25		0.16	

Norm:

Range	Descriptive Interpretation
$g > 0.7$	High Gain
$0.7 \leq g \geq 0.3$	Medium Gain
$g < 0.3$	Low Gain
$g = 0$ or $g = -n$	No Gain

Table 9
Summary of the t-test for the normalized gain between the modular instruction and traditional lecture groups

Topic	Mean		t	p-value	Decision
	Modular Instruction Group	Traditional Lecture Group			
Projectile motion	0.47	0.27	4.76	.000	Reject H_o
Impulse and Momentum	0.69	0.33	7.66	.000	Reject H_o
As a Whole	0.54	0.31	6.77	.000	Reject H_o

that the difference in the pretest mean scores between the modular instruction and traditional lecture groups is significant with the modular instruction group having a higher score than the traditional lecture group.

This finding is similar to the finding of Rugian (2001) and Alabaso (2012) that there is a significant difference between the posttest of the modular instruction and traditional lecture groups with the modular instruction group achieving higher than the traditional lecture group as proven by the result of t-test.

To further identify the effectiveness of the developed modules, the normalized gain was identified. Table 8 shows the frequency distribution of the normalized gain of the modular instruction and traditional lecture groups.

The table shows that most of the students under modular instruction group performed with a medium gain in projectile motion, impulse and momentum and as a whole while the students under traditional lecture group performed with a medium gain as a whole and performed with a low gain in projectile motion and medium gain in impulse and momentum. These further imply that the interventions used help the students to increase their performance particularly on the use of the developed modules

Table 9 presents the result of the t-test for the normalized gain between the modular instruction and traditional lecture groups.

In projectile motion, impulse and momentum and as a whole, p-value is less than .05. These imply that the difference in the normalized gain between the modular instruction and traditional lecture groups is significant with the normalized gain higher in the modular instruction group than that of the traditional lecture group. This finding is similar to the finding of Collado (2000) that the student performance is significantly enhanced by the modularized instruction as evidenced by the difference in the gain of students in the modular instruction group.

The results of the pilot testing show that contextualized modules can improve students' achievement in physics. This is supported by the finding of Bahtaji (2015) that contextualized instructional materials in physics lead to an improved performance of students in class. Furthermore, the contextualization of instruction as applied to modular instruction gives positive impact to students. This goes with the statement that regardless of the type of implementation, contextualized instruction shows positive impact on students' understanding (Bilican, Cakiroglu, & Oztekin, 2015; Chu & Treagust, 2014; & Dolphin, 2009). Lastly, the results show that contextualization of module can serve as a platform to enhance instruction which is parallel to the claim of Testa, Lombardi, Monroy & Sassi (2011) that contextualized modules has potential in improving teaching.

CONCLUSIONS

The validation phase showed that 1) the contextualized modules in physics are valid, 2) the modular instruction group performed better in the posttest than the traditional lecture group, and 3) the modular instruction group improved their performance better than the traditional lecture group as shown in the normalized gain. Thus, it is concluded that the contextualized modules in physics are effective materials in improving students' achievement in physics.

RECOMMENDATIONS

It is recommended that the modules in physics developed in this study be used and instructional materials particularly contextualized modules be developed by teachers to effectively employ contextualized instruction in the implementation of the K+12 curriculum.

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