International Journal of Evaluation and Research in Education (IJERE)
Vol.3, No.3, September 2014, pp. 169~174
ISSN: 2252-8822

Direct Instruction Model to Increase Physical Science Competence of Students as One Form of Classroom Assesment

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Article Info

Article history:

Received Jul 15, 2014
Revised Aug 20, 2014
Accepted Aug 30, 2014

Keyword:

Direct instruction
Mastery learning
Measurement concept

ABSTRACT

In designing the lesson teachers have to adapt the method or learning model with the material to be taught. In the teaching of measuring concept, students frequently faced with measuring instruments, micrometer, screw, scale, and so on. Direct Instruction Model would be suitable for teaching the measurement concepts specifically the skill of using measurement tools. The purpose of the study was to determine the level of students mastery on the concept of measurement through direct instructional model. Descriptive research with action in the class were used in this research to determine the level of students mastery on the measurement concept of the physical sciences in order to achieve competency. The samples were 25 seventh grade students on the second semester of academic year 2012/2013 of 11 Ambon State Junior High Schools. The instrument used was the test to measure the mastery of concepts. Performance test scores and daily tests are converted into the category of excellent, good, sufficient and poor. The results showed that the level of students mastery of the material is at very good and well with the percentage of the final results of formative student tests are 48.0% and 44.0% respectively. It can be concluded that the direct instructional model successfully improve student learning outcomes, especially to the concept of measurement.

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1. INTRODUCTION

Physics is a branch of natural science which examines the matter and energy in all its forms and manifestations [1]. As a part of natural science, physics is a subject that serves as a vehicle to develop capabilities such as the ability to analyze, interpret, process skills, and numeracy skills. In addition, as parts of the natural sciences are included in the national exams, the students' mastery of physics becomes very important. According to [2] physics is an important subject that is taught as a separate subject, especially at the level of senior high school/madrasah aliyah, because science can provide supplies to students, as well as a medium to develop the ability to think and solve problems in students life everyday. Based on national test results from year to year, the results of studying physics at the high school level is ranked relatively low [3]. While as cited in [4] that average score of physics of students in Indonesia (34,57) still far below international standards (43,40).

This low achievement was due to the relatively high obligation in studying physics which requires intelligence, sophisticated thinking skills, numeracy skills, observation sensitivity, as well as the skills to respond to a problem critically [3]. Physics subjects have conditional nature (comprehensive) which means that there is always a relationship between each concept. So the mastery of new concepts often require prerequisite understanding of the concepts previously learned. Therefore, if there is any difficulty took place

in learning a concept, it will influence the learning of the next concept, or if there is any misconception, this will likely to carry over to the next education level [3]. This is in line with what is stated in [4] that teaching physics at the junior high school level is aimed at increasing the knowledge, concepts, and skills to the next level. Thus, understanding of the concept and improvement of the students' understanding on physics at the junior high school level is indispensable.

On one side, sometimes students think that physics is a collection of formulas that must be memorized and applied when faced with questions [4],[6]. This presumption will increasingly affect poor learning outcomes, if not supported by the ability of teachers to teach physics properly. On the other side, in physics lessons, teachers tend to teachthe formulas instead of applying the practical concepts of physics itself. In addition, in delivery the lessons teachers still apply conventional learning patterns. Teaching is more focused on the flow of information from teacher to the students. Teachers portray themselves as orator, and students are considered to have no experience at all about the concepts being taught.

For the sake of changing the perception of students over the course, teacher must change the pattern of teaching. Teachers should not only speak continuously and dominate the lesson hours, but students should be actively involved in practical activities through simple experiments or research.For example, at the matter of measurement, students not only have to receive information from teachers about physical magnitudes and their measuring tools, but instead how teachers can dig knowledge of the students about the concept of physical quantities measurement or their measuring tools, as well as how to measure those matters encountered in everyday life. Furthermore, teachers can integrate and complement the students' understanding of concepts according to science, and involve the student's active participation in the experiment.

Curriculum 2004 competency-based curriculum is designed to produce graduates who are competent in the sense of having the knowledge, skills, attitudes and values reflected in the basic norms of thinking and acting. This goal can be achieved if the determination of learning programs are tailored to the characteristics of the subjects, standards of competence, as well as basic competencies to be mastered by students [7]. According to Karhami [8] there are three main things that need to be considered in the learning activities, they are 1) what materials to be taught, 2) how to teach them, and 3) how do we know that the learning process can take place appropriately and to what extent students can successfully master the materials. Thus, in designing teaching learning process, teachers must necessarily adapt the method or learning model with the material to be taught.

Direct instruction model is a learning model that has been commonly used in teaching and proven to be effective in improving student learning outcomes both in physics [9]-[11] and non-physical subjects [12], [13]. According to [14] direct instruction is a teaching model that is teacher centered, which means that the teacher is responsible for identifying learning objectives, and then play an active role in explaining the content or skills to students. By this model, the teacher demonstrates knowledge or skills to students step by step. Furthermore, students are given the opportunity to apply the concepts or skills they learned, and the teacher gives feedback. As stated by [9] that the advantage of direct instructional model is when the teaching learning process occurred, there is a communication that enables efficient exchange of information between teachers and students. The purpose of the current study was to determine the level of student mastery on the concept of measurement through direct instructional model.

2. RESEARCH METHOD

Descriptive research with action in the class was used in this research to determine the level of student mastery on the measurement concept of the physical sciences in order to achieve competency. The samples were 25 seventh grade students on the second semester of academic year 2012/2013 of 11 Ambon State Junior High Schools. The instrument used is the test items to measure mastery of concepts, namely: (1) performance tests to measure proficiency in the use of measuring tools made for teaching and learning activities to take place. (2) daily tests to measure the level of mastery of the concept of measurement. Total about twenty items in the tests in the form of objective tests (multiple choices) with wieght 1 for a correct answer and 0 for a wrong answer). Data results of performance tests to measure proficiency in the use of measuring tools were analyzed by calculating a qualitative descriptive (a) average, (b) standard deviation, (c) the range of the data, (d) the number of classes, (e) the length of the class, (f) distribution frequency, (g) the median, and (h) mode, whereas mastery of the concept data obtained through the daily tests, analyzed by quantitative descriptive. Performance test scores and daily tests are converted into the category of excellent, good, sufficient and poor.

3. RESULTS AND DISCUSSION

Based on the obtained data, the average value is 89.61, standard deviation is 47.92, ranged of the data (r) is 19, the total number of classes is 7, interval class length (p) is 3, the median is 87.3 and the mode is 84.4. The frequency distribution of performance results is shown in Table 1.

Table 1. Distribution of Performance Capabilities

Number	Level of mastery	Absolute frequency	Relative frequency (%)
1	81 – 83	5	20,0
2	84 – 86	6	24,0
3	87 – 89	4	16,0
4	90 – 92	2	8,0
5	93 – 95	3	12,0
6	96 – 98	2	8,0
7	99 – 100	3	12,0
	T o t a l	25	100

Based on Table 1, the data of 25 students are classified in 7 groups. 5 students scored between 81-83, or 20.0%, 6 students scored between 84-86 or 24.0%, 3 students scored 87-89 or 12.0%, 2 students scored between 90-92 or 8.0%, 2 students scored between 93-95, or 8.0%, 5 students scored between 96-98, or 20.0%, and 3 students scored between 99-100, or 12.0%. The results obtained through performance tests conducted in the learning process of science physics using direct instructional model is shown in Table 2.

Tabel 2. Score on Students' Performance

Number	Name of Students	Subject and Performance Score					Total Score
		Term slide	Screw micrometer	Ohause balance	Stopwatch	Amount of derivatives	
1.	AE	93	88	80	100	75	86,8
2.	BS	93	86	80	100	66,7	85,14
3.	CT	100	100	100	100	100	100
4.	DM	100	86	80	100	75	88,2
5.	FL	100	100	100	100	91,7	98,34
6.	HH	100	100	100	100	91,7	98,34
7.	JL	71	86	80	100	66,7	80,74
8.	IM	100	100	90	100	91,7	96,34
9.	KN	100	100	100	100	100	100
10.	LP	100	100	90	100	91,7	96,34
11.	I	86	71	80	100	75	82,4
12.	EB	79	86	80	100	66,7	82,34
13.	SK	100	100	80	100	83,3	92,66
14.	SL	100	100	100	100	100	100
15.	YP	86	86	80	100	66,7	83,74
16.	RY	93	100	80	100	83,3	91,26
17.	SS	79	86	80	100	66,7	82,34
18.	WT	100	100	80	100	100	96
19.	YT	100	86	80	100	83,3	89,86
20.	SN	100	100	80	100	83,3	92,66
21.	RA	93	86	80	100	66.7	85,14
22.	SM	100	100	80	100	66,7	89,34
23.	MT	86	71	80	100	66,7	80,74
24.	RP	86	86	80	100	66,7	83,74
25.	IN	86	86	80	100	66,7	83,74

From Table 2, it can be seen that the highest score on measurements using a measuring device, stopwatch. In overall all the students were able to conduct measurements, whereas in the form of the conversion score for each measurement can be presented as in Table 3.

Table 3. Conversion of Performance Tests Score

Level of mastery	Frequency	Percentage (%)	Qualification
90 – 100	11	44,0	Excellent
75 – 89	14	56,0	Good
65 – 74	-	-	Sufficient
< 65	-	-	Failed
	25	100	

From Table 3, it can be seen that the students who gained score of 75-89 (56.0%) were 14 students and those who obtained 90-100 (44%) were 11 students. The results obtained from the performance test have put the students in the very well level, as evidenced by the lowest score of 80.74 and the highest score is 100. Thus it can be said that the 25 students who enrolled in Physics at the subjects of measurements have completed the lesson satisfactorily. After the implementation of student learning performance by using direct instructional model, the formative tests (test day) were conducted and the results can be seen in Table 4.

Table 4. Conversion Score of Formative Test

Level of mastery	Frequency	Percentage (%)	Qualification
90 – 100	12	48,0	Excellent
75 – 89	11	44,0	Good
65 – 74	-	-	Sufficient
< 65	2	8,0	Poor
	25	100	

Based on the results obtained in Table 4 it is explained that there were 2 students received the score <65 (8.0%) are 11 students with scores ranged from 75-89 (44.0%), and 12 students with score between 90-100 (48.0%). The test results (daily tests) are categorized as very well. This is shown by 23 students were succeeded, while only 2 students who were not succeeded. Thus it can be said that as many as 23 or most of the students categorized in hands-on learning thoroughly while only 2 students did not complete the requirements (failed). Then the results obtained from the study of physics science at class 7.1 where direct instructional model was applied on the subject of measurement with evaluation techniques of performance test and formative tests as a whole can be obtained the result as presented in Table 5.

Table 5. The Results of Performance Test and Daily Test

Number	Name	Performance Score (0,3)	Daily test Score (0,7)	Total Score	Final Score
1.	AE	26,04	56,0	82,04	82,0
2.	BS	25,54	56,0	81,54	82,0
3.	CT	30,0	70,0	100,0	100,0
4.	DM	26,46	56,0	82,86	83,0
5.	FL	29,50	66,5	96,0	96,0
6.	HH	29,50	66,5	96,0	96,0
7.	JL	24,22	56,0	80,22	80,0
8.	IM	28,90	63,0	91,90	92,0
9.	KN	30,0	66,5	96,50	97,0
10.	LP	28,90	63,0	91,90	92,0
11.	I	46,60	57,4	82,0	82,0
12.	EB	24,72	52,5	77,22	77,0
13.	SK	27,80	59,50	87,3	87,0
14.	SL	30,0	70,0	100,0	100,0
15.	YP	25,12	59,50	84,62	85,0
16.	RY	27,38	59,50	86,88	87,0
17.	SS	24,70	59,50	84,20	84,0
18.	WT	28,80	66,5	95,3	95,0
19.	YT	26,96	63,0	89,96	90,0
20.	SN	25,54	63,0	88,54	89,0
21.	RA	25,54	63,0	88,54	89,0
22.	SM	26,80	63,0	65,80	66,0
23.	MT	24,22	35,0	59,22	59,0
24.	RP	24,22	38,50	62,72	63,0
25.	IN	24,22	59,5	83,72	84,0

From Table 5, it is seen that the highest final score were gained by 2 students, which is 100 and the lowest final score achieved by 1 students, which is 59, while 22 students obtained the final score between 63-97. These results can be percentage using Criterion Reference assessment as shown in Table 6.

Based on Table 6 it is shown that students who scored < 65 is as much as 2 students (8.0%), while student who received grades 65-74 is 1 student (4.0%), the students who received grades 75-89 were 13 students (52 , 05), and students who scored 90-100 are as many as 9 students (36.0%). These results show that there are 23 students who belong to successful group(completed), while there are 2 students who qualified as failed (not finished).

Table 6. Conversion of Score of Performance Tests and Formative Test

Level of mastery	Frequency	Percentage (%)	Qualification
90 – 100	9	36,0	Excellent
75 – 89	13	52,0	Good
65 – 74	1	4,0	Sufficient
< 65	2	8,0	Poor
	25	100	

Discussion

Based on the results of formative test it shows that the mastery level of student learning outcomes onthe measurement concept by using direct instructional model has increased where as many as 23 students categorized in excellent and good level. Therefore, it can be said that direct instructional model in this study was succeeded in enhancing students learning outcomes and the level of mastery of the students themselves. This is due to the fact that in this learning model, students are not just given the subject matter, but also directed to conduct direct learning activities, thus encourage them to explore and experience the learning by themselves. Through this learning model, students will become more active and motivated to be involved in learning activities. Additionally, in accordance with the demands of a competency-based curriculum, the students are required to be more actively seek, do tasks on their own, and explore information related to learning materials, whereby the previous model of learning that makes teacher as the center (teacher centered), turn to emphasize the more role of students (student centered), and the teacher only acts as a facilitator or mediator who serves to guide and direct students to perform learning activities.

In relation to direct instruction model, it can be said that learning involves acquisition of competencies that achieved over times through experiences where part of that experiences are the feedback from environment. Furthermore, as stated by [15], study by modeling occurs by observing the behavior of others and its consequences. According to Bandura as cited in [15], there are four phases involved in the learning through models namely: attention, retention, reproduction, and motivation. Thus the direct instructional model also shows the activity of the students who are at least follow the four steps proposed by Bandura, wherein the attention phase, students will pay their attention to the attitude or behavior of those around them, such as teachers or their friends in learning activities.

Furthermore, students reveal retention and reproductive phase where by paying attention and observing, the student will be directed to produce something, for example by following the example to measure, describe, and so on. Then finally the students are motivated to learn, so these factors if intrigued within the students, it will give significant impact on their learning outcomes.

Due to the advantages of direct instruction, this model can also be implemented on a wider scale, making it especially useful for distance learning with older students. As education expands to more areas and is disseminated to increasingly diverse learners, this method of instruction is likely to be usefull. It allows for students from all range of ages to interact with an instructor and obtain valuable information [16].

4. CONCLUSION

Based on the results and discussion, it can be concluded:

1. Mastery level of the students on measurements concepts is categorized into excellent and good level with the percentage of the final results of formative student tests are 48.0% and 44.0%, respectively.
2. Direct instructional model was successful in improving student learning outcomes and the level of student mastery, especially for measurement concepts.

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