ISCE : Journal of Innovative Studies on Character and Education
ISSN 2523-613X
Volume 4 issue 2, Year 2020
Journal homepage : http://iscjournal.com/index.php/isce

THE EFFECTIVENESS OF APPLYING DIRECT LEARNING MODELS TO IMPROVE CHEMICAL LEARNING OUTCOMES CONCEPT OF OXIDATION AND REDUCTION REACTION

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ARTICLE INFO

Article history:
Received: 28 Aug 2020
Accepted: 12 Oct 2020
Published: 16 Nov 2020

Keyword:
Direct Learning,
Learning Outcomes

ABSTRACT

The purpose of this study is to analyze and determine the effectiveness of the application of direct learning models to improve learning outcomes in chemistry subject to oxidation-reduction reactions. This research was conducted at Ensino Secundário Geral Publico 99 Atauro Timor Leste. The subjects in this study were students of grade 12 Natural Science. The tools used in this study were learning outcome tests, learning sheet, lesion plan, Learning Outcomes Test. The instrument was the Learning Management Observation Sheet, THB, Question Grid, and student responses. Using observation, test, and questionnaire techniques approach to get the data. Data management in this study was carried out using descriptive analysis techniques. The research results show that the resulting learning tools are proven to be effective and good, and teachers can manage to learn well and on time and all TPK are prepared thoroughly. Meanwhile, mastery learning for THB was 0.37 or 37% with an increase in the proportion of students' correct answers from an average of 0.43 to 0.80. After the teacher applied the direct learning model, 100% of students said they were happy with the components and were interested in participating in teaching and learning activities, 80.95% of students said the language used was quite easy to understand and 19.05% said it was easy to understand, and 26.19% said it was quite clear and 73.81% said it was clear.

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INTRODUCTION

National education is a manifestation of development in the life of a nation. Education has a very important role in ensuring the development and continuity of the life of the nation concerned. To educate human resources for the development and development of the nation, quality education needs to realize national goals.

The objectives of national education formulated in the Constitution of the Democratic Republic of Timor Leste article 59 on education and culture, especially paragraphs 1, 2, and 4. In the world of education in general, it is through a process of teaching and learning activities. To optimize teaching and learning activities and develop good results is the obligation of a teacher, where the teacher is the determinant of the success of students, in this case, students, in the teaching and learning process. To design teaching and learning activities that can stimulate learning outcomes effectively and efficiently for each subject, it requires the ability of teachers to select and use adequate and good delivery methods.

The approach or method used by the teacher in providing subject matter must be supported by the availability of facilities in schools to achieve learning objectives and learning tools that are prepared so that it is used by the teacher. According to Nur (1999), learning tools are one of the factors that affect the quality of learning. The teaching methods used by teachers can influence students' motivation and attitudes towards a teaching program. The teaching method is a means of interaction between teachers and students in teaching and learning activities, teachers need to make decisions about appropriate teaching methods and effective learning activities. This is necessary to ensure that most students can achieve learning objectives within the appropriate timeframe.

Based on information from teachers in the field of study as well as from teachers in other fields regarding the methods used in teaching and learning activities, generally using lecture methods, assignments, and exercises. The teacher as a learning manager has not optimally prepared other learning tools, according to the content of the material so that students are enthusiastic about taking the lessons given. Besides, students at the school every year have difficulty understanding the concept of oxidation and reduction reactions. Some of the alumni who have graduated said that every time they were tested, most students felt less happy about the concept and always got minimal scores in chemistry because of the concepts of oxidation and reduction reactions. Where of the students only the researchers asked to obtain preliminary data about student learning outcomes on the concept of oxidation and reduction reactions, showed that 28% said it was easy, 13% was quite difficult and 40% said it was difficult and 19% said it was very difficult.

LITERATURE REVIEW

Direct Learning Model

Direct learning is a teaching model that can help students learn basic skills and obtain information taught systematically. The direct learning model was created specifically to make it easier for students to learn well-planned declarative and procedural knowledge. In the direct learning model, there are 5 phases, which were summarized in the following table.

Table 1 Direct Learning Model

Phases	Action	Learning Theory
1. Convey objectives and prepare students	The teacher delivers TPK, background information on the importance of lessons, preparation	Learning Theory Behavioral: Skinner, behavior formation. Social Learning Theory: Bandura, Retention Stage, Motivation and reinforcement
2. Demonstrating knowledge or skills	The teacher demonstrates knowledge correctly or provides information step by step	Behavioral theory (Skinner, behavior formation), Systems Analysis Behavioral modeling theory (Bandura, Attention Stage
3. Provides guided practice	Teachers plan and provide initial training guidance	Social Learning Theory (Bandura Stage of Attention, Retention, Motivation, and Strengthening).
4. Check to understand and provide feedback	The teacher checks whether the students have succeeded in doing the assignment well, the feedback material.	Theory of Behavior (behavioral consequence skinnier), Social Learning Theory (Bandura, Motivation, and Strengthening Stage).
5. Provide opportunities for implementation training	The teacher prepares for the opportunity to carry out advanced training, especially its application to complex situations and everyday life	Social Learning Theory (Bandura, Production Stage.
(Source: Wariani, 2001)		

Learning objectives can be planned jointly by teachers and students, this learning model is more teacher-centered. The teaching management system ensures an effective teaching and learning process for students, especially through planned observation, listening, and recitation (Neto, 2003).

Several historical and theoretical backgrounds underlie the rationale for direct learning models, including ideas from systems analysis, social learning theory, or behavior modeling theory and research on teacher effectiveness. Historically, some aspects of this model derived from training procedures developed in the military and industrial fields.

Research on teacher effectiveness Several studies conducted around 1970 by Arends in Neto (2003) show that teachers who organize their classes well will allow structured learning to take place, resulting in a high student engagement ratio (time task ratio) and higher learning outcomes than teachers. It uses a less formal and less structured approach. Behavioral modeling theory Social learning theory named learning through observation or behavior modeling theory. According to Bandura, humans learn through selective observation and remembering others. Behavioral modeling theory goes through the following 4 phases: Observer attention or attention can pay attention to behavior best when the behavior is clear and not too complex.

Retention - retention of observational on behavioral results was confirmed if it is meaningful and cognitive repeats. Production allowing students to carry out activities that have just been learned is an important stage. Timing and teacher

feedback are also important factors in successful training. Student motivation will get reinforcement when imitating the actions of a model. Students pay attention to models, train behavior, and produce behavior models. Reinforcement is also important for sustaining learning

System Analysis

Systems analysis is learning how to break down parts of a whole so that students learn in small steps, which is theoretical support for Skinner's direct theoretical teaching. The most important principle of behavior learning theory put forward by Skinner is that behavior changes according to with immediate consequence of the behavior.

Learning achievement

The term learning achievement is utilized to indicate a process of achieving the level of success of the learning efforts that are prepared. Learning is often associated with activities that bring change to each individual, both in terms of abilities, knowledge, skills, and attitudes as well as regarding changes that occur in several aspects of human ability that become one from personality. It is related to the concept of learning, the understanding of learning achievement will lead to a learning goal.

Learning outcomes are the main benchmarks for determining one's learning success. Someone who has high learning outcomes showed that he has succeeded in learning, and vice versa. Meanwhile, to achieve a learning outcome from the teaching and learning process, a student is influenced by various factors both internal and external factors.

Learning outcomes are outcomes that are obtained (Poerwodarminto, 2001). Learning outcomes are the results achieved by school students indicated by changes in knowledge, skills, and attitudes because of individual efforts to interact with their environment. The learning outcomes achieved are addressed in the form of a report card, which is given after each test.

Learning achievement is the result that has been achieved by students after carrying out a series of learning activities in the form of changes in behavior in the form of cognitive, psychomotor, and affective which can be seen from learning achievement at school ". Thus, learning achievement is the measurement result of the learning effort assessment, which is expressed in the form of symbols, numbers, letters, or sentences that tell the results achieved by each child in a certain period. Learning achievement is the result of measurements of students which include cognitive, affective, and psychomotor factors after participating in the learning process as measured by using relevant test instruments. In learning, every student must compete for good learning achievement, because this is also a good thing.

In general, the factors that influence learning outcomes were grouped into two categories, namely internal factors, and external factors. These two factors influence each other in the individual learning process to determine the quality of learning achievement.

Student Internal Factors

Internal factors are factors that come from within the individual. Internal factors include physiological and psychological factors. Physiological factors are factors related to the physical condition of an individual. Physiological factors are divided into two, namely the physical condition and the condition of the senses.

Psychological factors are a person's psychological state that can affect the learning process. Some of the psychological factors that influence the learning process are students' intelligence or intelligence, motivation, interests, attitudes, and talents.

External Factors

External factors that can influence learning classified into two types, namely social environmental factors and non-social environment.

Social environment

The factors that include the social environment are the school social environment, the community social environment, and the family social environment.

Non-social Environment

The factors that include a non-social environment are natural environment, instrumental factors, and subject matter factors. The natural environment consists of fresh air, not hot and not cold, the light that is not too bright or strong, or not too weak or dark, and a cool and calm atmosphere. Instrumental factors consist of school building learning tools, learning facilities, sports fields, school curriculum, school regulations, and manuals, and so on. The subject matter factor consists of the teacher's mastery of the subject matter and the methods used by the teacher in delivering the subject matter.

From the explanation above, it has many factors that influence students in their learning. It is divided into two, namely internal factors and external factors. Which of these two factors can still be further divided into physiological, psychological, environmental, and instrumental factors.

Learning Approach Factors

The learning approach is a method or strategy used by students in supporting the effectiveness and efficiency of the learning process of certain materials.

METHOD

The researcher used experimental research in this study (Habib & Soliman, 2015; Lavy & Nixon, 2017). The research was conducted at Ensino Secundario Geral Público 99 Atauro, Dili district, Timor Leste. The subjects in this study were 42 students of grade 12 of Natural Science. The devices used in the teaching and learning process by applying the Direct Learning model are Student Teaching Materials (STM), Learning Units (LU), Learning Plans (LP), and Learning Outcomes Test (LOT). The research instrument used to test the effectiveness of Teaching and Learning Activities by applying the Direct Learning Model using the above tools, namely: Learning Management Observation Sheet (LMOS), Learning Outcomes Test (LOT), Question Grid, and Student Responses. To obtain data in this study, the authors used several data collection techniques, namely: Observation, Tests, and Questionnaires.

The data analysis technique used in this research is the descriptive analysis technique. The purpose of this descriptive analysis is to describe the activities of teachers and students during the learning process and student learning outcomes. Descriptive analysis is an analysis of the symptoms and conditions currently experienced by the subjects under study (Subana & Sudrajat, 2009; (Purswell & Ray, 2014). There are two observers involved in this activity as observers. Where the observer analyzes and assesses the teacher's ability to manage the class. As a quantitative measure of assessment, the following conditions are used: (1) 00-1.99: Not good, (2) 00-2.99: good enough, (3) 00-3.49: Good, (4) 50-4.00: Excellent

The reliability of the direct learning observation instrument was calculated using the presentation of the agreement technique. During the teaching and learning process, two observers used the same instrument to observe the same variables. The formula used to calculate reliability (Wariani, 2001: 49 in Seran, 2006) is:

Percentage of agreement $= \left(1 - \frac{A-B}{A+B}\right) x100\%$

A and B show the frequency of the behavioral aspects observed by the observer, giving high and low frequencies, respectively. A learning management instrument is said to be good if the reliability coefficient is > 0, 75, or 75%. To determine the completeness of the objectives and completeness of student learning outcomes used test instruments student learning outcomes. Determination of completeness based on a benchmark reference assessment. The mastery reference used is the completeness of the school in Ensino Secundario Geral Público 99 Atauro, that is why students to have studied if the proportion of students' correct answers is P ≥ 0.60. Meanwhile, a class was complete if 75% of students or more have the proportion of correct answers> 0.60 or 60%. To calculate the completeness of the learning outcome indicators, a proportion equation is used (Depdikbud, 1994 in Wariani 2001).

$$P = \frac{\text{Total right answer}}{\text{Total participants of Test}}$$

The sensitivity of the items was calculating the sensitivity of each item to determine the extent to which the item was able to measure the learning effect. The question has to answer correctly by all students, before and after learning, then that item can measure the effects of learning. If a question did not answer correctly by all students before and after learning, then the question does not fulfill its function. Moreover, the sensitive questions answered by students after learning than before. To calculate the sensitivity of the items using the formula (Grounlund in Wariani; 2001) as follows:

$$\left(S = \frac{R_A - R_B}{T}\right)$$

RESULT

The implementation of the learning tools was using at Ensino Secundario Geral Público 99 Atauro with the research subjects of grade III science students. The

analysis of the research results used a descriptive model that generally describes the average score, proportion, and percentage. The following describes the results of the study and analysis of the learning test data.

The results of observations on direct learning management during the teaching and learning process were using the Learning management Observation Sheet. Briefly presented in the following

Table 2. Direct Learning Management Assessment

No	Observed aspects	Skor Each Rond			Average score	Obs
		Rd. 01	Rd. 02	Rd. 03		
1	preliminary	3.50	3.75	3.83	3.69	Good
2	Core activities	3.67	3.57	3.75	3.66	Good
3	Closing	3.50	4.00	4.00	3.83	Good
4	Time management	3.50	3.50	3.50	3.50	Good
5	Class arrangement	3.75	3.75	3.75	3.75	Good

From the table above, the average score for each category of teaching and learning activities includes an introduction, core activities, closing, time management, and class atmosphere. The results of the observations showed in the table above show that in general, the teacher's ability to manage to learn is good (Wolff et al., 2015). Teachers in operating learning tools with appropriate time allocations and make students enthusiastic in participating in learning.

Observations made by two people, namely a class I mathematics teacher and a class III physics teacher. Thus, the results of the observations can be trusted or not by calculating the reliability of the instrument (Da Costa, 2018). If the reliability coefficient is ≥ 75%, then the instrument is in a good category. Meetings or Teaching Plans for three or three meetings, where the results of the reliability calculation of direct learning management instruments as in the following table:

Table 3. Reliability of Direct Learning Management Instruments

Observation of	Reliability every RP (%)		
	RP. 01	RP. 02	RP. 03
Guru	98.85 %	98.95 %	97.96 %

From the table above, it showed that the reliability of the direct learning management instrument for each item exceeds 75%, so it showed that teacher can apply the direct learning model properly according to the learning steps. Learning Outcomes Test. The instrument learning outcome test is used to determine student learning outcomes as measured by the completeness of 10 items. Based on the curriculum and the decision that an item is said to be complete if the proportion of students' correct answers is P ≥ 0.60. Analysis of learning outcomes tests as in the following table:

Table 4. CPD completeness and the sensitivity of the Learning Outcomes Test

No	Specific learning objectives (TPK)	items	P. Items		S	P. TPK	Ket P ≥ 0,60
			U1	U2			

A	B	C	D	E	F	G	H
Students are expected to							
1	Reaction defining the meaning of the reaction	1 2	0.36 0.48	0.88 0.79	0.52 0.31	0.84	Completed
2	Explain the concepts of oxidation and reduction in terms of the binding and releasing and accepting reactions of electrons	3 4	0.55 0.45	0.83 0.67	0.28 0.22	0.75	Completed
3	Explain the concept of oxidation and reduction in terms of the reaction of electron acceptance and release.	5	0.43	0.9	0.47	0.90	Completed
4	Explain the concept of oxidation and reduction in terms of changes in oxidation numbers	6	0.45	0.83	0.38	0.83	Completed
5	Defining the meaning of oxidizing and reducing agents	7 8	0.55 0.33	0.74 0.67	0.19 0.34	0.71	Completed
6	Determine the oxidizing and reducing agents in the redox reaction equation	9	0.33	0.57	0.24	0.57	Non-Completed
7	Defines the definition of an auto redox reaction	10 11	0.38 0.50	0.88 0.93	0.50 0.43	0.91	Completed
8	Determine the oxidation number of the elements in compounds and ions	12	0.48	0.83	0.35	0.83	Completed
9	Balancing the redox reaction equation using the half-reaction method	13	0.45	0.79	0.34	0.79	Completed
10	Balancing the redox reaction equation using the oxidation number method	14	0.57	0.88	0.31	0.88	Tuntas
Total			0.43	0.80	0.37		Tuntas

Source: Research results, 2018

In the learning outcome test, one item has not been completed, such as items number 6. Where the incomplete instrument contains the determination of the oxidizer and reducing agent in the redox reaction equation. The incompleteness of this instrument resulted from the students' lack of understanding of the Redox reaction equation.

Based on the sensitivity of the items, each item means to be sensitive to measure the effect of learning, because there is no sensitivity for negative items. The table above shows that the direct learning model approach can increase the proportion of students' correct answers from 0.43 to 0.80. The completeness of individual student LOT learning can be the following table.

Table 5. Completeness of learning LOT Product

No	Num	P	Completeness p≥0,60		No	Num	P	Completeness P ≥ 0,60
1	001	0.79	Complete		22	022	0.71	Tuntas
2	002	0.86	Complete		23	023	0.86	Tuntas
3	003	0.93	Complete		24	024	0.79	Tuntas
4	004	0.71	Complete		25	025	0.86	Tuntas
5	005	0.79	Complete		26	026	0.86	Tuntas
6	006	0.86	Complete		27	027	0.79	Tuntas
7	007	0.71	Complete		28	028	0.79	Tuntas
8	008	0.79	Complete		29	029	0.93	Tuntas
9	009	0.71	Complete		30	030	0.71	Tuntas
10	010	0.71	Complete		31	031	0.71	Tuntas
11	011	0.79	Complete		32	032	0.93	Tuntas
12	012	0.79	Complete		33	033	0.79	Tuntas
13	013	0.79	Complete		34	034	0.86	Tuntas
14	014	0.79	Complete		35	035	0.86	Tuntas
15	015	0.79	Complete		36	036	0.71	Tuntas
16	016	0.79	Complete		37	037	0.86	Tuntas
17	017	0.86	Complete		38	038	0.79	Tuntas
18	018	0.79	Complete		39	039	0.79	Tuntas
19	019	0.79	Complete		40	040	0.71	Tuntas
20	020	0.86	Complete		41	041	0.93	Tuntas
21	021	0.79	Complete		42	042	0.71	Tuntas
					Rata-rata		0,80	Tuntas

From the table above, it shows that the application of the direct learning model approach can help students complete their learning outcomes. Based on the average value of the proportion of correct answers of 0.80 it means that the learning outcomes of students in grade 12 of Natural Science (experimental class) have been completed. This is because 100% of grades 12 of Natural Science students as an experimental class (research) have P-value > 0.60 so that the class is complete. Student Responses to Learning Devices Retrieval of student response data to learning devices that using student response.

No	Statement	Respond	%
Senang atau tidak senang terhadap komponen KBM			

I	1. learning material 2. Worksheets provided 3. Student Teaching Materials 4. Learning activities in class 5. Practice questions	Happy Happy Happy Happy Happy	100 100 100 100 100
II	Yes or not interested in joining the next KBM	Yes	100
III	Comments on student teaching materials Language Clarity of writing	Quite easy to understand Easy to understand Quite clear Clear	80,95 19,05 26, 19 73,81

Based on the table above, it shows that 100% of students say they are happy with the teaching and learning components that use the direct learning model approach and are interested in participating in the next teaching and learning activities. Of the student teaching materials, 80.95% of students said the language used was quite easy to understand and 19.05% said it was easy to understand. Regarding the clarity of writing, 26.19% said it was clear enough and 73.81% said it was clear.

DISCUSSION

Based on the implementation of learning tools, the results of the research are discussed to determine their suitability with theoretical studies as follows from the results of the analysis of the implementation of the direct learning model approach, teaching, and learning activities result according to the stages. This implementation can be realized because of the availability of learning tools. The learning material was well prepared and neat so that it makes it easier for teachers in learning activities. Another supporting factor is the availability of worksheets (Saputra et al., 2018). From this description, it means that the implementation of each LP in the LOT is determined by the availability of learning tools. This is following Nur (1999) who said that one of the factors affecting the quality of learning is the availability of learning tools.

The results of this study showed that the instruments developed in this study are good. The direct learning management instrument has a reliability of more than 75%, it is in a good category (Borich, 1994). The LOT instrument developed has a positive sensitivity so that it can measure learning effects. Descriptive in the initial test and final test, there was an increase in the proportion of students 'correct answers to the proportion of students' answers to 0.80. This shows that after students take the teaching and learning activities that apply the direct learning model there is an increase in learning ability by 0.50 or 50% and 100% of the third-grade students have a proportion value> 0.60, then class completeness can be achieved. Thus, the teaching and learning process that applies the direct learning model can improve the quality of learning and the achievement of optimal learning outcomes on the subject

of oxidation reactions and achieving optimal learning outcomes on the subject of oxidation and reduction (redox) reactions

Based on the analysis of the Learning Outcomes Test is one item that has not complete. The items that have not been completed are the item regarding the determination of the oxidizer and reducer in the redox reaction equation requires a basis for a good understanding of the meaning of oxidizer and reduction (Chaves et al., 2016). However, as a whole the items used in this LOT are complete. This can be proven by the results of the learning test which showed an increase, namely from 0.43 the proportion of students' correct answers in the initial test to 0.80 in the final test. Student responses to the application of the direct learning model approach were generally good, namely, 100% of students said they were happy with the teaching and learning components that used the direct learning model approach and were interested in participating in the next teaching and learning activities (Lester & Cross, 2015). About teaching materials, 80.95% of students said the language used was quite easy to understand and 19.05% said it was easy to understand. Regarding the clarity of writing, 26.19% said it was clear enough and 73.81% said it was clear.

CONCLUSION

Based on the results of the descriptive analysis and the above discussion, the authors conclude that the application of direct learning models is effective and good for achieving learning objectives in chemistry subjects, especially on the subject of Oxidation and Reduction Reactions. Because, the research results show that teachers can prepare learning tools properly according to the direct learning model, besides that the teacher also manages to learn well and on time because all instruments are prepared completely, with the proportion of completeness > 0.75. Students can achieve mastery learning from the learning outcomes test on the final test which is 0.80. Student responses to the application of the direct learning model approach were generally good

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