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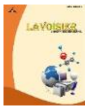

Development of Science Process Skill (Science) Assessment Instruments in Poe (Predict, Observe and Explain) Learning Model on Acid-Base Titration Materials

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Abstract

This research was about the development of an instrument assessment of skills the process of science in learning POE (predict, observe and explain) in titration acid bases, in significance this assessment instruments contains aspect of science process skills i.e. aspect of observation, classification, interpretation, prediction, making the question, hypotheses, design experiments, using tools and materials, applying concepts and communicate that categorized on stage learning POE. This assessment instruments was developed to the matter titration acid bases based on the analysis of KD in 2013 curriculum. Research methodology used is DDR (design and development research). The assessment is an instrument developed through 3 stages, namely: (1) study design (concept of a development), (2) stages of development, and (3) stages of evaluation. The purpose of this research is to produce an instrument for skill process of science in learning POE on titration acid base. This research include the development and products finally tested to 22 respondents by 22 students class XI MA Dharma Karya UT, South Tangerang. Based on the data so can be concluded this instrument has characteristics: assessment is organized by using stage POE, now housed assessment ten aspects skill the process of science, now housed assessment discourses whose characteristics are in accordance with matter or the concept of titration acid bases and environment students as well as this assessment use rubrics with scales 0-4 for diplomatic learning can be assessed in detail. Based on the percentage the average from the validation the people of, pilot products and chief responsi teachers, products this assessment get the percentage an average of 84,71 % and into category is very good.

Keyword: *Learning and Teaching, Motivation, Reward and Punishment, Stoichiometry*

1. Introduction

The Indonesian curriculum, namely the 2013 curriculum directs students to be active in the learning and teaching process. This curriculum is student-centered so that it makes it easier for teachers in the assessment process and the potential of students in the learning process can be observed.

The 2013 curriculum really supports the learning process in science. In science learning, students are emphasized to have direct experience in developing competencies to understand the natural surroundings through the process of "finding out" and "doing", this will help students to gain a deeper understanding. (Zulfiani, et al, 2009: 48) but the fact is that in the field students are not used to it and are accustomed to trying to find knowledge or information on their own (Conny et al, 1988). For this reason, it is expected that science learning must continue to be developed to encourage student curiosity when in the learning process and make it easier for teachers to assess students so they know the level of achievement in the learning process.

Science learning that will support the process of finding out and doing is known as Science Process Skills (KPS). KPS can improve students' ability to find concepts by being provided with process-oriented (*student centered*) learning activities. (Zulfiani et al, 2009).

Science Process Skills

KPS are skills that scientists usually do to gain knowledge. KPS is built from three manual, intellectual, and social skills. In accordance with the characteristics of science related to how to systematically find out about nature, not just facts, concepts, principles but emphasizes discovery. (Zulfiani , *et all* , 2009). So KPS is a student-centered learning process in understanding and applying science through stages that combine theory and events (phenomena) so that it can be proven in experiments or from events that exist in everyday life.

The indicators of Science Process Skills (KPS) used in this research are observation, classification, interpretation, prediction, asking questions, hypothesizing, planning experiments, using tools/materials, applying concepts, and communicating.

a. *Observation*

This skill relates to the optimal and proportional use of all the senses to describe objects and space-time relationships or to measure the physical characteristics of the observed objects. (Zulfiani et al, 2009). Another definition of observation is " *for an image of observing in action let's return to the example of someone given in their hand an object which resembles a shell* ", that is, when a person is given an image or object to find out about it, sensory devices are used, not only by seeing but also by other senses (Harlen, 1996).

b. *Classification*

The basis of classifying skills is the ability to identify differences and similarities between various observed objects. These types of skills are classifying, comparing, contrasting, and sorting. (Zulfiani *et al*, 2009). According to Setiawan et al. (1988), in making a classification it is necessary to pay attention to the basis of classification, for example according to a special feature, purpose or certain interests.

c. Interpretation

Interpretation includes the skill of recording observations in the form of numbers, connecting observations, finding regular patterns from a series of observations to arriving at conclusions. (Zulfiani, *et all*, 2009). The ability to interpret or interpret data is one of the important skills generally mastered by scientists. (Setiawan et al, 1988).

d. predictions

Predicting skills include the skills to propose predictions about something that has not yet happened based on a trend or pattern of existing data. (Zulfiani *et al*, 2009). Based on the results of observations, suggest what might happen in circumstances that have not been observed. (Dahar, 1986).

e. Asking question

This skill is actually a fundamental skill that must be possessed by students who have not studied a problem further. (Zulfiani, *et all*, 2009). The questions asked can ask for an explanation, about what, why, how, or ask for a hypothetical background. (Nuryani, 2005).

f. hypothesize

The hypothesis states the relationship between two variables or proposes an estimate of the cause of something happening. (Zulfiani, *et al*, 2009). A hypothesis is a reasonable estimate to explain a particular event or observation (Setiawan, *et all,* 1988).

g. Planning Experiments

Skills in determining the material tools needed to test or investigate something, the Student Worksheet (LKS) does not specifically include the tools and materials needed. (Zulfiani, *et al*, 2009).

h. Using Tools/Materials

In this case the skills used are skills when students use tools/materials that have been planned in accordance with the reasons and how to use the tools/materials when going to do experiments (Nuryani, 2005). Using tools and materials in an experiment. (Dahar, 1986).

i. *Applying Concepts*

Skills in using understood concepts to explain new events, applying mastered concepts to new situations or applying formulas to solving new problems (Zulfiani et *al,* 2009).

j. Communicate

Read graphs, tables or diagrams, describe empirical data with graphs, tables or diagrams, explain experiments, compile and deliver reports in a systematic and clear manner. (Zulfiani *et al,* 2009). Explain the results of experiments or observations, discuss the results of experiments. (Nuryani, 2005).

Predict, Observe and Explain (POE) -based learning through the learning stages and grouping the KPS aspects into each POE stage.

The predict, observe and explain (POE) learning model

POE (Prediction, Observation and Explanation) is a learning model that can investigate students' ideas and how to apply knowledge to actual situations (practicum), to investigate it requires questions that can explore these three abilities, namely questions that can predict, observe and explained. (Yunita and Subarkah, 2012). The stages in POE learning:

1. *Predict*

Prediction or making predictions, is a process of making assumptions about a natural phenomenon. (Prioritas, 7).

2. *Observe*

Observation , namely conducting research/observation of what happened to an event, at this stage investigations/trials/experiments can be carried out, data collection, and data analysis to test the predictions that have been proposed (Prioritas, 2014).

3. *Explain*

Explanation (explanation), namely giving an explanation about the suitability between the allegations and the experimental results from the observation stage (Prioritas, 7).

Overall the POE learning stages with the 10 KPS aspects that will be used have a relationship with each other. At the *Predict stage* as the beginning of learning to start the learning process so that students can be active with the KPS aspects that appear are observation, classification, interpretation, prediction, asking questions and making hypotheses. Then at the *Observe stage* the KPS aspects that were raised were planning experiments and using tools and materials. And at the *explain stage,* the KPS aspects that are raised are communicating and applying concepts.

The material used in this study is acid-base which is focused on acid-base titration practicum. This acid-base titration process is carried out by providing student worksheets (LKS) as a start to lure students into being active in asking questions and seeking information in answering questions in the LKS with reference to the 2013 curriculum with basic competencies (KD) 4.11 designing, implementing, and conclude and present the results of acid-base titration experiments. Therefore the researcher tries to develop this assessment instrument through the stages which will later be described in the research method.

Evaluation

In the learning process an assessment instrument is needed. Assessment (*assessment*) is a general term that includes all the methods commonly used to assess the performance of individuals or groups of students. (Husamah and Yanur, 2013). Self-assessment is a process of assessing student activities in the learning process both individually and in groups.

There are 2 types of assessment, namely tests and non-tests. In this study, the non-test assessment was used. Non-test assessment measuring tools in the form of the use of questionnaires, interviews and observations (Sofyan *et al* 2006).

Then, other assessment measuring tools are self-evaluation measuring tools in the form of: scoring models, ranking models as well as rating scales and rubrics. (Sukardi, 2008). A rubric is a set of scoring criteria used to evaluate student work and assess student work. (Husamah and Yanur, 2013). The rubric of one of the instruments used in this research contains various kinds of statements that direct *observers* in the assessment process according to learning activities that take place either in class or in the laboratory in the form of tables with the use of a scale of 0-4.

2. Research Method

The research method used is DDR (*Design and Development Research*). *Design and development research seeks to create knowledge grounded in data systematically derived from practice. We define this type of research as: Richey and Klein* (2009) said that *the systematic study design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development.*

The results of the development were tested at SMA Dharma Karya UT, South Tangerang, semester II (even). This trial was conducted to find out the results of the development of assessment instruments in assessing KPS aspects in POE learning and the products developed will also be assessed by the teacher. The time for the implementation of this research was in April in the even semester of the 2014/2015 academic year.

DDR (*Design and Development Research*) is a systematic development process based on practice data. This process consists of a systematic design, development and evaluation process that will produce development products that can later be used in learning either as models or tools.

Research design

The DDR method used in this study has 3 stages, namely design, development and evaluation studies. From the above, the researcher can make a development research design through the chart below: **The first stage** is a design study, namely creating a development concept. At this stage, the researcher tries to make an initial design of the assessment instrument that will be used in the learning process**.** the researcher collects needs analysis by conducting school observations to see the KPS assessment instruments that have been used by teachers in the learning process, after that conducts KD analysis which will be used in research instruments so that the learning stages can make it easier to classify KPS aspects into learning POE, then performs an analysis of grouping PPP aspects into POE learning stages by linking the theory in each POE explanation (*Predict, Observe and Explain*) with the theory contained in each explanation of the PPP aspects used assisted by analysis KD (Basic Competence) regarding acid-base titration and the last in this second stage is making instruments that will be developed and later validated by supervisors and other lecturers (expert validation) which will later be used in the learning process. **The third stage** is the evaluation stage, which contains the results of the validation of experts and supervisors and the results of product trials at schools and is added to the results of product assessments carried out by chemistry teachers to see whether the instruments developed can be categorized as very good, good, sufficient, lacking and very lacking. . For a more concise research design can be seen in Figure 1.

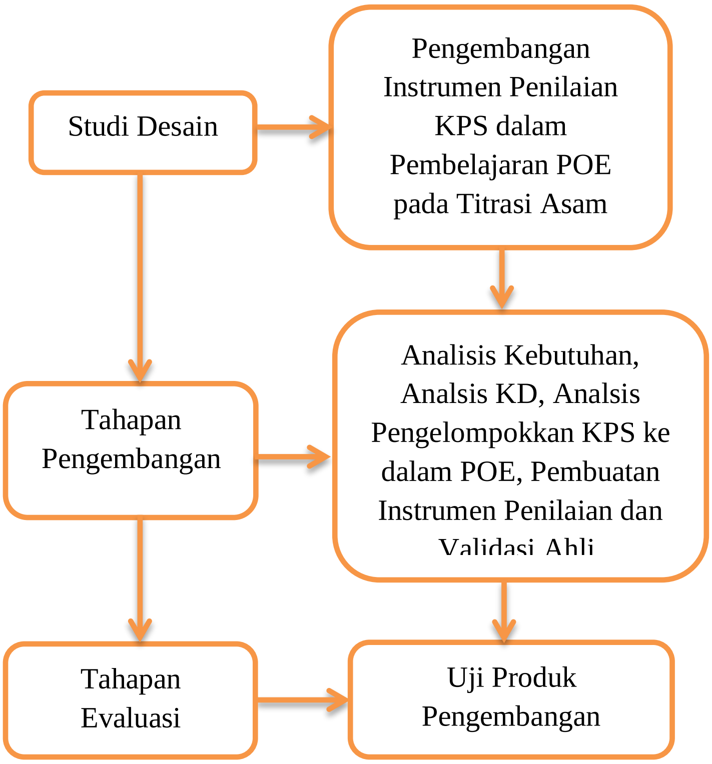

Figure 1. Research Design

Data collection technique

The data collection techniques used were: First, field studies (needs analysis) the instruments used were observation sheets and interviews, then the collection technique was by collecting assessment instruments used by teachers in schools and the observation time was carried out from January to February, secondly there was an analysis KD is in the form of a table which describes the indicators in KD 4.11 by linking it to the material, the POE model and KPS aspects, the third analysis is grouping KPS aspects into POE in the form of tables to group KPS aspects into learning POE by analyzing the meaning of the POE stages along with the explanation of each KPS aspect, the four expert validations, the instrument along with the yes and no checklist questionnaire, given to two lecturers as expert lecturers in the validation process of the assessment instruments developed as well as suggestions from lecturers supervisor, and the fifth is a response in the form of an assessment questionnaire with a scale of 0-4 which is given to chemistry teachers to assess other assessment instrument products that have been developed.

Research Instruments

In this study there are several research instruments used at each stage. First, when conducting a needs analysis, the instruments used were yes and no questionnaires and interviews. Second, when carrying out KD analysis the instrument used is in the form of a table containing KD analysis 4.11 namely designing, conducting, concluding and presenting the results of acid-base titration experiments and relating them to KPS aspects used in POE learning. Third, an analysis of the grouping of PPPs into POEs by using tables by linking the understanding of the aspects of the PPPs used into the POE stages. Fourth, the expert validation instrument used is a yes and no questionnaire with a scale of 1 for yes and 0 for no along with a suggestion column. And the fifth is responsiveness, the instrument used is a questionnaire with a scale of 0-4 which will later be used as an assessment of the product being developed.

Data analysis technique

The data that has been obtained from the teacher's response questionnaire is tabulated and then the percentage is sought and analyzed. The percentage calculation uses the following formula:

$$Persentase = \frac{\text{Skor yang diperoleh}}{\text{Skor total}} \text{ X } 100\%$$

The data that has been presented will be changed in the form of a predicate so that it is easy to read and understand so that it makes it easier to conclude that the assessment of learning media is included in the very good, good, sufficient, poor or very poor category according to the assessment guidelines used by Sunarto (2012: 2 3) .

Table 1. Score Interpretation Criteria

No.	**Score Intervals**	**Category**
1	81-100%	Very good
2	61-80%	Good
3	41-60%	Enough
4	21-40%	Not enough
5	0-20 %	Very less

3. Result and Discussion

This study aims to determine whether there is a significant effect on learning using the reward and punishment method on students' learning motivation on stoichiometric material at public school at Pekanbaru City. The research was conducted in 3 meetings on stoichiometry in the mole concept sub-material. The data presented in this study consisted of conducting instrument trials and implementing treatments using the reward and punishment method on students' motivation.

An instrument is said to be good if validity has been carried out. In this study, the questionnaire was validated by a chemistry education lecturer at the Education and Teacher Training faculty at one of Islamic State University in Riau. After conducting content validity, 25 valid questionnaire statements were obtained, so the researcher used 25 questionnaire statements.

Data from the validity of the questionnaire instrument trial can be seen in the attachment below (see Table 2):

Table 2. Summary of Testing the Validity of Questionnaire Statement Items

No	Criteria	Total	Item Number	Percentage (%)
1	Valid	17	1, 2, ,3, 4, 5, 8, 9,12, 13, 14, 15, 16, 17, 20, 23, 24, 25	68%
2	Invalid	8	6, 7, 10, 11, 18, 19, 21, 22	32%
Total	25	25	100%	

From the results (Table 2) it can be concluded that of the 25 statement items have a correlation coefficient moving between 0.065 to 0.718 and there are 8 statement items that have r-count <r-table. Thus the 8 statement items are not used as statement items in collecting data about student motivation because it is invalid. And there are 17 statement items that are said to be valid because the value of r-count > r-table.

Reliability test to determine the consistency of the instrument measuring instrument to be used. This reliability test uses SPSS 16 with Alpha Cronbach's technique. The data obtained is as follows:

Table 3. Nilai Questionnaire Reliability Value of Student Learning Motivation Trial

Variable	Cronbach Alpha	Description
Student Learning Motivation	0,8552	Reliable

The results obtained from the table above are Cronbach's alpha value of 0.8552. This value indicates that the trial data of the student learning motivation questionnaire instrument has a high reliability value.

This homogeneity test data was taken through the teacher's consideration of low student learning motivation and from the daily test scores of three 10^{th} grade chemistry classes. The results obtained are the box's M value of 1.91 with a significant value of $0.39 > 0.05$. So the homogeneity test data from three 10^{th} grade is declared homogeneous. And the classes taken for research were first class as experimental and second class as a control.

Based on the results of the questionnaire on student learning motivation in class A (experimental class) and class B (control class), the results of student answers were obtained from the questionnaire instrument that had been given.

The total score obtained from the research is 1666. So based on that data, the percentage of research results is:

$$P=F/N \times 100\%$$

$$P=1666/2108 \times 100\%$$

$$P=0,7903 \times 100\%$$

$$P=79,03\%$$

The figures that have been presented are then matched with predetermined categories and it can be concluded that the learning motivation of students in the experimental class with a percentage of 79.03% belongs to the high category. The total score obtained from the control class research is 1529. So based on that data, the percentage of research results is:

$$P=F/N \times 100\%$$

$$P=1573/2108 \times 100\%$$

$$P=0,7462 \times 100\%$$

$$P=74,62\%$$

The percentage that has been presented is then matched with the predetermined categories and it can be concluded that the learning motivation of students in the control class with a percentage of 74.62% belongs to the high category. Thus it can be concluded that in the experimental class the percentage of the motivational questionnaire is greater than the percentage results of the control class.

This normality test aims to determine whether the data is normally distributed or not.results obtained (see Table 4 and Table 5):

Table 4. Normality Test Results Pre-test and Post-test Experiment Class

Data	*Kolmogrov-smirnov*	
	***Kolmogrov-smirnov* Z**	***Asymp*.sig. (2-tailed)**
Pre-test	0,49	0,97
Post-test	0,66	0,77

Table 5. Normality Test Results of Pre-test and Post-test Control Class

Data	*Kolmogrov-smirnov*	
	***Kolmogrov-smirnov* Z**	***Asymp*.sig. (2-*tailed*)**
Pre-test	0,73	0,65
Post-test	0,69	0,72

Based on the normality test data above, using the Kolmogrov-Smirnov test the pre-test and post-test data for the experimental class were normally distributed.

Both classes are equally normally distributed. Pre-test experimental class Asymp.Sig. (0.97)>0.05, post-test experimental class Asymp.Sig (0.77) > 0.05, pre-test control class Asymp.sig. (0.65) > 0.05 and post-test control class Asymp.Sig. (0.72) > 0.05. This test was carried out to see the data for the same variant value results are as follows:

Table 6. Results of Homogeneity Test of Variance of Pre-test and Post-test of Experimental Class

Homogeneity Test of Variance			
Levene Statistic	**df1**	**df2**	**Sig.**
3,189	1	60	0,079

Table 7. Results of Homogeneity Test of Variance of Pre-test and Post-test of Control Class

Homogeneity Test of Variance			
Levene Statistic	**df1**	**df2**	**Sig.**
2,109	1	60	0,152

From the Table 6 an 7 above it is found that the experimental class has a level statistical value (F) of 3.189 with a significant value of 0.079. And in the control class it has a level statistical value (F) of 2.109 with a significant value of 0.152. The data is said to be homogeneous if the significance value is >0.05. From the data above, in the experimental class it can be concluded that the H0 is accepted so that the experimental class is said to be homogeneous because Sig. (0.079) > 0.05. And in the control class it can be concluded that the H0 is accepted so that the control class is said to be homogeneous because Sig. (0.152)>0.05.

Then a t-test was performed using SPSS 16 with a paired-sample t-test results obtained:

Table 8. Experiment Class T Test Results

Paired Samples Test			
Pair 1 pre-test post-test	**T**	**Df**	**Sig. (2-*tailed*)**
	-3,720	30	0,001

Dari From the table above we can see the value of t0 = -3.720 with a Sig value .(2-tailed) of 0.001. when viewed from the value of the Sig.(2-tailed) number is 0.001, this means it is smaller than 0.05. So the null hypothesis (H0) is rejected (0.001 <0.05). And it can be concluded that the results of the t-test from the pre-test and post-test of the experimental class there were significant differences before being given rewards and punishments and after being given rewards and punishments.

Tabel 9. Control Class T Test Results

Paired Samples Test			
Pair* 1 *pre -test post-test	**T**	**Df**	**Sig.(2-*tailed*)**
	-1,575	30	0,126

From the table above we can see the value of t0 = -1.575 with a value of Sig.(2) -tailed) of 0.126. when viewed from the value of the Sig.(2-tailed) number it is 0.126, this means it is greater than 0.05. So the null hypothesis (H0) is accepted (0.0126 <0.05). And it can be concluded that the results of the T test from the pre-test and post-test of the control class there is no significant difference before being given reward and punishment with after being given reward and punishment

. From the research results it can be concluded that in this study there was a significant influence giving reward and punishment to students' learning motivation on stoichiometric material with an effect coefficient of 10.126%. Thus, the provision of reward and punishment can be used by teachers in increasing student learning motivation because high learning motivation will result in better learning achievement.

4. Conclusion

Based on the results of the data analysis, it can be concluded that there is an effect of reward and punishment on students' learning motivation in stoichiometry material. This can be proven from the results of the T test using SPSS 16, the value of t-0 (-3.720) > t-t (2.04) with a Sig. (2-tailed) value of 0.001, so it is less than 0.05 (0.001 < 0, 05). So, the null hypothesis (H0) is rejected and Ha is accepted. Thus, in this study there was a significant difference between the pre-test and post-test with an effect coefficient of 10.126%. The results of the percentage of students' learning motivation questionnaire found that the percentage in the experimental class (79.03%) was greater than the results of the percentage of motivation in the control class (74.62%). Giving reward and punishment method is successful in increasing student motivation. A strong sense of competition in learning is evident in the experimental class. This is also proven from the results of the analysis of students' learning motivation questionnaire which is categorized as high.

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