PRACTICE SCIENCE PROCESS SKILLS THROUGH INQUIRY LEARNING MODELS IN CHEMICAL EQUILIBRIUM TOPIC IN SMAN 1 MANYAR

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Abstrak

Tujuan dari penelitian ini adalah untuk mendeskripsikan keterlaksanaan model pembelajaran inkuiri pada materi kesetimbangan kimia di SMAN 1 Manyar, untuk mengetahui hasil keterampilan proses siswa setelah diterapkannya model pembelajaran inkuiri, dan untuk mengetahui hasil belajar siswa. Penelitian ini merupakan penelitian deskriptif kuantitatif dengan tipe preeksperimen dengan rancangan penelitian menggunkan *"One shot case study"*. Intrumen yang digunakan dalam penelitian ini adalah lembar observasi keterlaksanaan model pembelajaran inkuiri, lembar tes keterampilan proses, lembar tes hasil belajar, dan lembar observasi aktivitas siswa. Berdasarkan hasil penelitian, rata-rata kemampuan pengelolaan pembelajaran inkuiri pada pertemuan 1 sebesar 80,47% sedangkan pada pertemuan 2 sebesar 86,80%. Untuk hasil keterampilan proses siswa dikatakan tuntas pada setiap aspek keterampilan, antara lain nilai rata-rata keterampilan merancang percobaan sebesar 83,83; nilai rata-rata keterampilan melakukan koleksi data sebesar 85,56; nilai rata-rata keterampilan menganalisis data sebesar 81,81; dan nilai rata-rata keterampilan membuat kesimpulan sebesar 94,72. Hasil belajar siswa diperoleh nilai rata-rata kelas adalah 76,67 dan dikatakan tuntas secara klasikal sebesar 83%.

Kata kunci: model pembelajaran inkuiri, keterampilan proses, kesetimbangan kimia

Abstract

The aim of this research are to describe the implementation of inquiry learning model in chemical equilibrium topic in SMAN 1 Manyar, to ascertain the result of the students' aptitude after implementing the learning model and to ascertain the students' learning result. This research is a type of descriptive quantitative studies with pre-experiment type by using "one shot case study". The instruments used are inquiry learning model implementation observation sheet, processing skill test sheet, learning result test sheet and students' activities observation sheet. Based on the result, the students' ability in inquiry learning model implementation in the first meeting is around 80.74% while in the second meeting, it increases to 86.80%. The result of students' processing skill is completely achieved in every aspect. Students' average percentage of designing experiment is around 83.83%; collecting data is around 85.56%; analyzing data is 81.81%; and drawing conclusion is 94.72%. The rate of students' learning result is 76.67 and it is said classically complete by 83%.
Keywords: *inquiry learning model, science process skill, chemical equilibrium*

INTRODUCTION

Chemistry is a branch of science which is seen as the process and product. Due to that state, the process of finding concept cannot be neglected in learning chemistry. Today's chemistry learning process emphasizes the characteristic of chemistry as product rather than process. As the result, students' processing skill is considered low. Chemistry as a process includes skills and attitudes owned by scientists to acquire and develop knowledge. Skills is called science process skills. Chemistry as product includes a set of knowledge consists of facts, concepts and principles of chemistry.

Processing skill of science is important to be learnt and mastered by everyone. If someone has mastered the processing skill, it means that he has also mastered the skill which is needed in higher learning level, e.g., doing research and solving problem. Skill of solving problem and research are categorized as life skills so that they are considered as the highest learning level.

The government regulation number 19 in 2005 (*Peraturan Pemerintah nomor 19 tahun 2005*)[1] about Standard Education, it is said that the standards of graduates' competence include attitude, knowledge and skill. These mean that the graduates are expected to comprehend particular skills such as processing skill.

Processing skill in scientific world consists of attitude, process and product. Indarwati in Trianto[2] said that processing skill is the whole aimed science skill (cognitive or psychomotor) which can be used to find an exist concept or to deny a finding. The skill is completely included in four basic competences of Curriculum 2013 which must be involved in every learning material. According to Rustaman[3]

processing skill needs to be developed through direct experiences as live learning. Besides that the Indonesia Law Number 20 in 2003 (*Undang-Undang Republik Indonesia Nomor 20 Tahun 2003*)[4] about National Education System Chapter I Article I (1) education is: "a planned effort to actualize learning atmosphere and process so that the students actively improve their self-potential to have religious power, self-control, identity, intelligence, attitude and aptitude which are needed by them, society and the country".

The curriculum which is implemented by Indonesian government these days is Curriculum 2013 as the replacement of the previous one, KTSP (*Kurikulum Tingkat Satuan Pendidikan*). The latest curriculum is in line with *UU nomor 20 tahun 2003*. According to Sudarwan[5] in Curriculum 2013, Scientific Approach is emphasized (it consists of observing, questioning, trying, processing, presenting, concluding and creating for all subjects). Based on the observation conducted in August 8th 2014 at SMA Negeri 1 Manyar with 80 students in X, XI and XII grades, it was noticed that 68% students coped with difficulty to understand chemistry material because it was complicated, abstract, and difficult to understand; but 97% students are interested and enthusiastic toward the experimental activity. 68% students stated that the experimental activity was done only by following the procedures or instructions without they getting involved in designing the trial and determining the equipments and components.

The questionnaire of 30 students in XI grade, it was noted that 47% students could not explain of science method well, 73% students could not explain the steps of science method, 87% students could not state and explain the variables in a certain

trial, and 80% students could not explain appropriately the functions of the experimental equipments. Besides, the interview to the teacher shows that during the experiment, students were really enthusiastic although they only follow the existed procedures because they were not quite capable to design their own experiment

Related to the inquiry research which is conducted by Meli[6] the learning activity of reaction rate through managing guided-inquiry-based experiment can attract students' interest and motivation to improve their processing skill with high rate of N-Gain. Besides, the research which is conducted by Nurina[7] also shows the success of inquiry learning model in rate of reaction material. The result shows that inquiry learning model can sharpen the students' processing skill related to the factors affecting the reaction.

Based on the above explanation, it is needed to develop a learning model which can sharpen students' processing skill in science, e.g., inquiry learning model. According to Amri and Ahmadi[8], inquiry learning model facilitates students' with real experiences to develop their skill in solving problem, drawing decision and managing research. Due to that state, inquiry learning model is believed effective and appropriate to sharpen students' processing skill. Appropriate materials are needed in inquiry learning model. Chemical equilibrium is the chosen material because it has basic competences such as designing, doing, concluding and presenting the trial results of the factors affecting the rate of equilibrium shifting.

These backgrounds encourage the researcher to conduct a research entitled Practice Science Process Skill through Inquiry Learning Model in Chemical Equilibrium Topic in SMAN 1 Manyar..

METODE

This research is a pre-experimental research in the form of descriptive qualitative. The subjects are XI grade students in SMA Negeri 1 Manyar.
One shot case study design is chosen as the design which is described as:

$$X \rightarrow O$$

Note:
O : the treatment result by using inquiry learning model
X : treatment is the teaching-learning process by using inquiry learning model.

In this research, learning components are syllabus, lesson plans, relevant textbooks and exercise books, while the instruments are inquiry learning model implementation observation sheet, processing skill test sheet, learning result test sheet and students' activities observation sheet.

Data collection techniques are involved: observations of the implementation of inquiry learning model, observations of students' activities, and students' processing skill test results, students' learning test results.

Observation data analysis of the implementation of inquiry learning model is interpreted by using score in the table 1.

Table 1 interpretation Score of the implementation of syntax learning quality

Score	Criteria
5	Very Good
4	Good
3	Enough
2	Not Good
1	Is Not Done

The data from the observation were then processed in the form of percentage by using the following formula:

$$Precentage = \frac{\sum Score}{Maximum\ score} \times 100\%$$

The results are interpreted in accordance with the interpretation criteria scores are summarized in the following table.

Table 2 criteria of score interpretation

Precentage (%)	Criteria
0-20	Very Bad
21-40	Bad
41-60	Enough
61-80	Good
81-100	Very Good

Students' processing skill rate is computated by using the following formula:

$$Process\ skills\ value = \frac{\sum score}{\sum maximum\ score} \times 100$$

Students' processing skill is achieved when every individual gets the minimum score of ≥ 67 and they are considered classically succeed when there are 67% of the students obtaining ≥ 67 as the minimum score.

Students' activities observation sheet is analyzed by using this following formula:

$$\%\ score\ activity = \frac{sum\ of\ each\ activity}{all\ of\ activity\ in\ 90\ minutes} \times 100$$

While the students' Score learning outcomes is analyzed by using this following formula

$$Score\ learning\ outcomes = \frac{right\ answer}{total\ question} \times 4$$

The score of this learning result is interpreted with the criteria of the following Table 3.

Table 3 score conversion of individual comprehension

Value Knowledge Competence	Predicate
3.67 - 4	A
3.34 - 3.66	A-
3.01 - 3:33	B +
2.67 – 3.00	B
2.34 - 2.66	B-
2.01 – 2.33	C +
1.67 – 2.00	C
1.34 - 1.66	C-
1.01 - 1.33	D +
0 - 1	D

Based on Table 3, the students are considered pass the standard if they reached B as the minimum score.

HASIL DAN PEMBAHASAN
Implementation Inquiry Learning Model

The result of the data retrieved is displayed in this following graph.
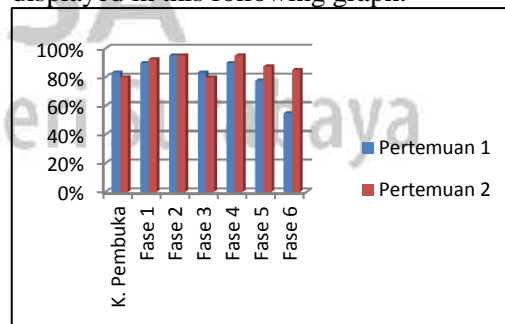

Figure 1 Comparison of Total Learning Completeness

Based on the data analysis, for the aspect of opening activity, the mean of management skill of inquiry learning model at the first and second meeting are 83.3% and 80%, respectively. For phase 1 (Planning), the mean of management skill of inquiry learning model at the first and second meeting reaches the same rate as much as 90%. For phase 2 (Retrieving) gaining information, the mean of management skill of inquiry learning model both at the first and second meeting is as much as 95%. For phase 3 (Processing), processing the information, the mean of management skill of inquiry learning model at the first and second meeting is 83.33% and 80%, respectively.

The phase 4 (Creating), creating information, the mean of management skill of inquiry learning model at the first and second meeting reaches out 80% and 90%, respectively. For phase 5, Sharing (communicating the information), the mean of management skill of inquiry learning model at the first and second meeting reaches out 75% and 85%, respectively. For the closing activity, phase 6, Evaluating (Evaluating the activity), the mean of management skill of inquiry learning model at the first and second meeting is 55% and 85%, respectively.

The mean score of the whole management skill of inquiry learning model reviewed from all aspects at the first meeting reaches out 80.47% which is categorized as fair while, at the second meeting, the mean rate reaches out 86.80% which is categorized as very good. Thus, it can be said that the management skill of inquiry learning model is effective. This is also supported by the increase of students' activity. At the second meeting, the students only took a little while to finish their exercises compared to their ability awhile back at the first meeting.

According Amri and Ahmadi[8] inquiry learning provides students with various real-life experiences and active learning encouraging them to take initiative in developing their problem solving skill, decision making skill, and research management that will enable them to be life-long learners. This is in accordance to the theory of cognitive development by Piaget[9] that sees the cognitive development as a process by which the students actively construct system of senses and comprehend the reality through their own experiences and interactions.

Processing Skill

The data of students' processing skill is the result of evaluation toward students' ability in comprehending processing skill which covers the ability of planning experiments, collecting the required data, and drawing conclusion. In SMAN 1 Manyar, students' processing skill is considered succeed if, individually, the students can pass the minimum score by ≥ 67 and the students are considered succeed classically if there are 67% of students gaining ≥ 67 as the minimum score. The data of students' processing skill were collected through written test administered at the end of the meetings.
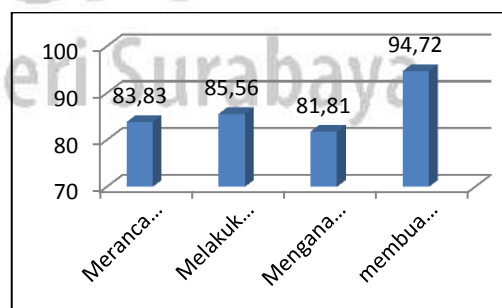

Figure 2 Mean Scores of Students' Processing Skill

Generally, it can be argued that the rate of students' processing skill fully established the overall aspects of processing skill. It shows that the implementation of inquiry learning can improve the students' processing skill. The mean scores of students' processing skill test reviewed by each aspects of processing skill are shown in Figure 2. This result is relevant to the previous studies; the research by Meli Siska et al entitled "*Peningkatan Keterampilan Proses Sains Siswa SMA Melalui Pembelajaran Praktikum Berbasis Inkuiri pada Materi Laju Reaksi*" which explains that the learning activity of reaction rate through managing guided-inquiry-based experiment can increase students' interests and motivation and it can develop students' processing skill by high rate of N-Gain.

Besides, the study by Nurina Yuliani entitled "*Melatihkan Keterampilan Proses Siswa pada Materi Faktor-faktor yang Mempengaruhi Laju Reaksi Melalui Model Pembelajaran Inkuiri*" shows a particularly positive result.
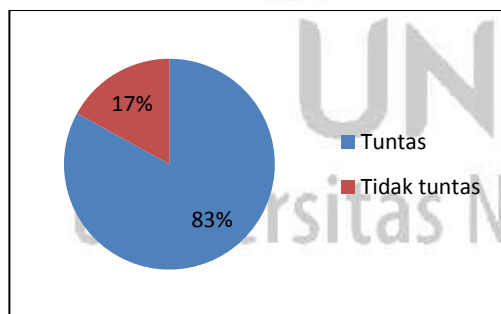
Learning Result

Figure 3 The Percentage of Accomplishment of Students' Learning Results

Teacher's ability to manage inquiry learning model can affect students' learning results as well. Based on the data of students' learning results shown in Table figure 3, it can be inferred that, classically, 83% of 36 students are considered pass the standard; students' mean score is as much as 76.67% by B+ as the predicate. 33 students are considered successful since they pass the standard and obtained B to A- as the predicate. There are 5 out of 36 students obtaining B- and one student obtaining C; these six students are considered failed the minimum score. It can be triggered as these six students' low processing skill compared to the other students who passed the minimum standard. Besides, the low test results can possibly stand as the consequence of students' internal factor or students' cognitive ability.

According to Indrawati in Trianto, generally, the teaching and learning process is more effective if it is conducted by utilizing information-processing-based learning model. It is so since this learning model focused on how the students think and how it affects the phase of information processing. One of the models is called inquiry learning model. Through this model of learning, the students are expected to be more active in retrieving and collecting information by conducting observations and experiments to seek for an answer or to solve a certain problem using their critical and logical thinking.

Therefore, inquiry learning model is appropriate to sharpen students' processing skill because processing skill is an important part of Science and, specifically, Chemistry which has to be comprehended by the students. It is expected that the students can invent scientific products such as facts or natural concepts through this scientific activity

similarly to what the former scientist had ever undergone before.

CLOSING

Conclusion

Based on the result of the study and the discussion, it can be concluded that:

1. The rate of implementation of inquiry learning model to sharpen students' processing skill obtains 80.47% (categorized as very good) and 86.80% (categorized as very good) as the percentages of the mean score of management skill of inquiry learning at the first and second meeting, respectively.
2. The students' processing skill results are considered accomplished the overall aspect of processing skill standards after the implementation of inquiry learning model. For instance, the mean score of designing research skill is 83.83; the mean score of collecting data skill is 85.56; the mean score of data analysis skill is 81.81; and the mean score of drawing conclusion skill os 94.72.
3. The mean of students' learning results is 76.67 by B+ as the predicate, and it is considered classically fulfilled by the rate of 83%.

REFERENCE

1. Departemen Pendidikan Nasional. 2005. *Peraturan Pemerintah Republik Indonesia Nomor 19 tahun 2005* tentang *Standar Nasional pendidikan*. Jakarta: Departemen Pendidikan Nasional.

2. Trianto. 2011. *Model-model Pembelajaran Inovatif Berorientasi Konstruktivistik.* Jakarta: Prestasi Pustaka.

3. Rustaman, N. 2005. *Strategi Belajar Mengajar Biologi.* Malang: Universitas Negeri Surabaya.

4. Depdiknas. 2003. *Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional*. Jakarta: Depdiknas.

5. Sudarwan. 2013. *Pendekatan-pendekan Ilmiah dalam Pembelajaran.* Jakarta: Pusbangprodik.

6. Siska, M., Kurnia, & Sunarya, Y. 2013. Peningkatan Keterampilan Proses Sains Siswa SMA Melalui Pembelajaran Praktikum Berbasis Inkuiri pada Materi Laju Reaksi. *Jurnal Riset dan Praktik Pendidikan Kimia , 1.*

7. Yuliani, N., & Dwiningsih, K. 2014. Melatihkan Keterampilan Proses Siswa pada Materi Faktor-faktor yang Mempengaruhi Laju Reaksi Melalui Model Pembelajaran Inkuiri. *Unesa Journal of Chemical Education, 3*, 35-40.

8. Amri, & Ahmadi. 2010. *Proses Pembelajaran Kreatif dan Inovatif dalam Kelas.* Jakarta: PT. Prestasi Pustakarya.

9. Nur, M. 2008. *Teori Pembelajaran Kognitif .* Surabaya: Unesa.