The Generic Science Skill Profile of Fourth Grade Students on Acid and Base Topic in Guided Inquiry Learning Model

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Info Articles

Abstract

This research aims to find and identify the 4th level students' science generic skill using guided inquiry learning in SMK Raja Permaisuri Bainun. This research method is descriptive qualitative method that explains the generic science skills indicators that have been studied through the Data taken from the research then Analyzed and summarized as research results. Profile of generic science skills valuation indicates that the indicator of student observation on acid and base material is high with the average of 81. Science Generic skills of symbolic language are classified with average of 73, while logical consistency and inference indicator are classified as high with average of 67 and 85 respectively. Overall, 4th Generic science skills of SMK Raja Permaisuri Bainin on acid and base material in guided inquiry learning is high enough with the average of 76.5. The analysis of students' cognitive learning outcomes guided inquiry learning was obtained in average of 73 and it indicated a high level of achievement. Furthermore, this result also indicated resources in the student's response to the guided inquiry learning that positively influences the students' science generic skills.

How to Cite

INTRODUCTION

The world of education has been progressing and growing rapidly. Development and these changes not only involve ideas and curriculum content but also the approach, principles and techniques of teaching and learning (Vebrianto, 2012). The development of the education system in Indonesia is now implementing the curriculum in 2013 as a reference implementation of education.

Curriculum 2013 aims to direct learners to master the four existing core competencies that are spiritual attitudes, social attitudes (affective), knowledge (cognitive), skills (psychomotor domains). The achievement of learning outcomes includes affective, cognitive and psychomotor that illustrates the quality of the balance between hard skills and soft skills (Kusuma, 2013). The evaluation of learning KBSM (Kurikulum Bersepadu Sekolah Menengah) includes three components, namely components of cognitive (intellectual), affective (emotional and spiritual), and psychomotor (physical) (Abdullah, 2015).

In addition, students must also have the skills to be able to carry out special tasks relating to the behavior of cognitive, affective and psychomotor as well as possible (Selvianti, 2013). Learning chemistry is not only judged by the cognitive learning alone but it needs to develop skills in thinking and acting or commonly called as generic science skills. Brotosiswojo (2001) stated that chemistry learning should be emphasized on generic science skills (GSS) to be applied in resolving the problems of everyday life. As revealed by S Sudarmin (2012) that a prerequisite for control of high-level thinking skills are science generic skills. Generic science skills is a scientific thinking skills through observation, awareness of the scale, symbolic language, inference logic, the law of cause and effect, logical frame, logical consistency, modeling and abstraction. Saptorini Bailey (2008) reported that the basic capabilities known as generic skills is the ability of a general nature and oriented to a higher science, and can be applied to a wider job.

Based on the results of observations through interviews with the chemistry teacher in SMK Raja Permaisuri Bainun, it is known that in the acid-base materials learners have difficulty in distinguishing strong or weak acid and a strong base or weak. This relates to the generic science skills of logical consistency. Learners are also difficult in interpreting the symbols and equations of chemical reactions associated with the symbolic language generic science skills. Learners feel that chemistry is a difficult subject because the concept is complex and abstract. This can be seen in the results of students in studying chemistry, only a few children who gained score in very high category. So based on these, it known that teacher still need to develop basic skills or generic science learners.

In chemistry learning, most of the chemical material can be associated and applied to phenomena that exist in everyday life. One of them is the acid-base, the presence of problems in everyday life that can be connected with this matter. In a study conducted Greulich, et al, (2016) showed that learners may be interested in science class when the topic is being studied and relevance to daily life and practical work.

According to the observation, it required a solution to explore the skills of learners. One model of learning that develops generic science skill learners is guided inquiry. Inquiry learning model is a model of learning that gives students the chance to have a real experience and active learning. In this learning model students are trained how to solve problems and make decisions (Rizal, 2014). Student centered learning with guided inquiry learning to effectively improve student learning outcomes (Yulianingsih & Hadisaputro, 2013). Students who apply inquiry learning could reach a value higher than traditional learning (Abdi, 2014). Therefore, the learning of chemistry can provide direct learning experiences through the use and development of process skills and scientific attitude (S Sudarmin, 2012). It is suggested that teachers give emphasis to the activities centered on learners so that learners' thinking can grow so as to give opportunities to understanding the optimum concept (Iksan, 2012).

Annisa (2016) with Guided Inquiry Learning Assisted Vee Diagram against Science generic Skills Learners are able to improve learning outcomes and science generic skills. On Anwar (2012) states that the design of worksheets students active learning-based cooperative showed the value of N-Gain significantly to the improvement of Science generic Skills. Science generic skills required students to learn various concepts and solve problems in materials science such as acids and bases. In acidic and alkaline materials

learning generic skills develop observation skills, symbolic language, logical consistency and logic inference.

Based on this background, the problem in this research is how to profile science generic skills of students in the observation indicator, symbolic language, logical consistency and logic inference in guided inquiry learning. The purpose of this study was to determine the profile of science generic skills of students in the observation indicator, symbolic language, logical consistency and logic inference in guided inquiry learning.

METHOD

This research method used is descriptive qualitative method. In this qualitative descriptive study, authors describe and explain the variables that have been studied through data drawn from the results of the study. Data then be analyzed and drawn a conclusion as a result of research. Descriptive research is generally conducted with the primary goal of systematically describe the facts and characteristics of the object or subject under study accurately (Sapuroh, 2010).

This research was conducted at SMK Raja Permaisuri Bainun in acidic and alkaline materials. The research subjects are learners level 4 Miu and 4 Rho numbering 33 which have been chosen using purposive sampling technique. Stages in the study were divided into three stages, including preparation phase, the implementation phase, later stages of data analysis and conclusions. The preparation stage of research including preliminary studies, development of instruments such as observation sheets, about KGS test and validation of research instruments. The implementation stage of research is learning to do as much as 4 meetings. The third stage is the stage of data analysis research and summarizing.

The data were collected using observation sheets, activity sheets learners, about the generic skills of science and documentation. The instrument is an objective matter. The study aimed at analyzing the profile of generic science skills of students based on the observation during the learning. Observation sheet analysis aimed to determine the profile of generic science skills of learners. The results of the study was measured using the analysis score (Wikhdah, 2015).

Percentage attainment of skills science generic using the formula according to Purwanto (2012: 102) as follows:

$$NP = \frac{R}{SM} \times 100\%$$

Remarks:

NP   = The percentage of generic skills science

R = Scores of students in each item of generic skills science

SM   = maximum score on eachscience generic skill item

RESULTS AND DISCUSSION

The result of this research consists of three types of key data collection includes science generic skills profile (1) observation, (2) the symbolic language, (3) the logical consistency and (4) inference logic.

Science generic skills are the basic skills needed to train students scientific work so as to produce students who are able to understand the concepts, solve problems, and other scientific activities, and be able to learn on their own to effectively and efficiently (Rosidah, 2017). These generic skills measured on the results sheet science generic skills based on students' learning. Recapitulation sheet averages obtained in generic skills for each indicator as shown in Figure 1:
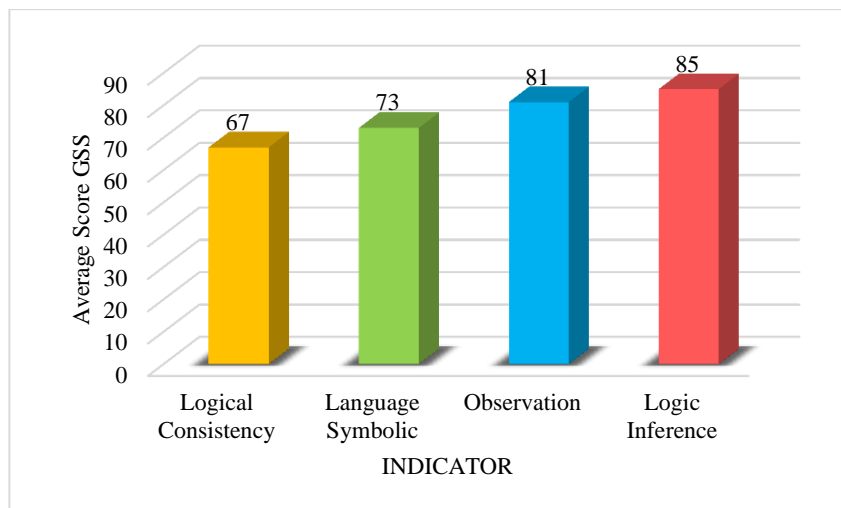
Figure 1. The Average Score Of Science Generic Skills Every Indicators

The highest average score was 85 achieved by generic science skills on logical inference indicators with high achievement rates, while the lowest mean score was 67 on generic science skills of logical consistency. Based on the data, the average science skill score of students is 76.5 which is high.The results of the analysis of every aspect of science generic skills as following:

1. Profile of Generic Skills Science Observation

Indicators of observation in this study is the first activity namely directly observation discoloration of the sample solution with a natural indicator as a pointer using acidic or basic properties. The second activity is to use a measuring tool as an aid in the sense of measuring the pH or acidity level of acid-base using universal indicator.

Based on Figure 1 the average science generic skills of observation is about 81. That observation indicators were obtained at the level of high achievement, as this skill is easy to implement basic skills learners, thus directly or indirectly they gain experience events observed. According Brotosiswoyo (2001) generic skills of direct and indirect observations categorized easily mastered.

The research is based on observation skills attainment in higher category and this is supported by the guided inquiry-based learning. Learners are given the opportunity to seek and find order matters relating to their own observations and experiences. In line with the opinions S Sudarmin (2015) science generic skills can be developed to provide a meaningful experience through problem solving and experimenting.

Learning based guided inquiry is an active learning where students are required to find answers to the allegations made of an issue to produce a concept. Guided inquiry learning is done on the identification of acid-base observations by utilizing materials that were around the school environment. So that students better understand the material to be motivated to be more active in learning.

Figure 2. (a) experiment with universal indicators (b) experiment with natural indicators

Learners do an acid-base identification experiment with universal indicators and natural indicators, then observe the results of the practicum performed. Learners write down the results of the lab work they get. Based on these experiences make students accustomed to find something new in solving the problem. So it can be said in the high achievement group and low able to perform better observations from other achievement groups. This means they already have generic science skills related to macroscopic and microscopic observations better after doing organic chemistry labs (S Sudarmin, 2012).

2. Generic Skills Profile Language Symbolic Science

According Rimatusodik (2010), serves to illustrate the symbolic language of symbols in science learning, for example in identifying symbol elements, chemical equations, symbols for unidirectional reaction, the reaction equilibrium, resonance and others in learning chemistry. Based on Figure 1 the symbolic language occupies the third position in the percentage of science generic skills mean that is equal to 73. This means that with the average obtained in the symbolic language indicator is at the level of achievement of the medium, due in part learners are still experiencing difficulties in penning ionization equation and differentiate acid strong base and weak. In this aspect, the students are required to write the name of the acid, acid formulas, equations ionization reaction and acid groups. These results are consistent with research Rosidah (2017) which states symbolic language science generic skills have the same average of 78.87 ranks three of the other indicators of science generic skills.

These skills are very supportive as a communication language that states a symbol, a sign of the chemical symbol, term, the meaning of quantitative chemical equations, as well as the ability to read graphs, tables and diagrams (Brotosiswojo, 2001). Stages inquiry made is currently holding discussions analyzing the ionization reaction, determine the acidic and basic compounds of formula and knowing the difference powerful acid-base reaction and weak in water microscopically. Therefore guided inquiry learning can develop generic skills symbolic language of science students in the category.

3. Profile of Generic Skills Science Logical Consistency

Skills Logical consistency in teaching organic chemistry related to the physical data of some organic compounds as a pattern of logical consistency of structure (S Sudarmin, 2012). Indicators of logical consistency in this study is a reference to the nature of acids and bases with acidity strength that shows the pattern of logical consistency. On this indicator, the students are required to understand the power of acidity that can distinguish a weak acid and a strong base.

Classically seen in Figure 1 the average science generic skills of logical consistency learners who obtained 67. That is, in the aspects of these skills learners in middle category because most learners are still lacking in determining the acidity strength and differentiate the strong base and a weak acid. Indications of this study are consistent with Sayak (2017) on practicum colligative properties amounted to 65.41% of logical consistency with the category enough. This can occur because of one of the weaknesses of this study which require a relatively longer time (Slameto, 1995). May occur as well as science generic skills of logical consistency is one skill that is quite difficult to make a regularity that is easy to understand learners. Active involvement of learners who can make the learning process more meaningful so that it can improve the understanding of the concept of the material being studied and can improve the character of learners (Wardani, 2016). Such learning makes it easier for students to think systematically according to the order of events and the regularity of phenomena (logical frameworks) so as to improve observing, analyzing and communicating skills (Vebrianto, 2012).

4. Profile Skills Generic Science Logic Inference

SkillsInference Logia is a required capability for solving the problem so as to empower students to be able to collect the responsibility for defining and analyzing the problem so that students are able to make a conclusion (Matthew, 2011). The conclusions drawn can be either an explanation or interpretation of the results of an observation or study or in the form of conclusions on the new problems as a logical

result of the conclusions or theories Indicators of inference logic in this study are interesting conclusion after an experiment or observation of symptoms chemicals by the previous law ,

Based on Figure 1 the average science generic skills of logical inference learners obtained at 85. That is, in the aspects of these skills learners are at a high level of achievement. Learners are required to make an explanation, solved the problem by trial and referral, and draw conclusions based on experiments related thereto classified learners able to carry it out properly.

This is in line with research Septiani (2013) the average value of the experimental class logic inference skills in the second praktium increase that is 4 to a high category. Similarly, the study of logic inference Risna indicator increased by 11.72%, this is because students are getting used to using the skills of thinking in solving problems. This concludes the activities can help students improve inference logic. This is consistent with the statement S Sudarmin (2015) which states that the inference logic can be proved through chemical experiments, the activity of thinking in the activities conclude the experiment, summarizes the activities of important terms or concepts that can improve the inference logic.

Based on the results of the discussion related to the profile of generic science skills in the classical mean science generic skills of learners of 76.5 to a high category. This is related to the implementation of inquiry learning model that focuses on student learning and put the teacher as a facilitator, so that students will engage more actively in learning. This means that in learning chemistry at school is not enough to pay attention to cognitive aspects, but the affective aspect (scientific attitude) and psychomotor (performance) is also absolutely be considered can assist students in mastering the concepts and acquire scientific attitudes and life skills (Rizal, 2014).

Friesen Research (2012) which states that acquiring skills in an investigation is more important than merely producing a product or establishing an invention. In line with the research conducted by Arrita (2011) and Kiswanto et al. (2005) on guided inquiry learning model that can be improved its observation skills, symbolic language, performance, mastery of concepts, and scientific attitude. Munawaroh & Fatmaryanti (2016) has stated that there are effects of guided inquiry learning model application against a science generic skills of students.

CONCLUSION

These results indicate that the profile of 4th level students' science generic SMK Raja Permaisuri Bainun has average of 81 in observation skills. Science generic skill in symbolic language indicator is obtained in average of 73. Science generic skill of logical consistency is obtained in average of 67. amilan science generic on logic inference indicators obtained averages 85 with high criteria.

REFERENCES

Abdi, A., 2014. The Effect of Inquiry-Based Learning Method on Student's Academic Achievement in Science Course. *Universal Journal of Educational Research.* 2(1): 37-41.

Abdullah, Norazilawati. 2015. Planning and Implementation of School-Based Assessment (SBA) Among Teachers. *Procedia-Social and Behavioral Sciences*. 211:247–254. doi.org/10.1016/j.sbspro.2015.11.031.

Annisa, Nurul Husna & S Sudarmin. 2016. Pengaruh Pembelajaran Guided Inquiry Berbantuan Diagram Vee Terhadap Keterampilan Generik Sains Peserta didik. *Jurnal Inovasi Pendidikan Kimia.* 10(1): 1692-1701.

Arrita. (2011). Pengaruh Inkuiri Laboratorium Terbimbing Terhadap Keterampilan Generik Sains Siswa SMA Pada Kelarutan dan Hasil Kali Kelarutan. *Jurnal Pendidikan.* 2(1): 254-266.

Brotosiswojo, Benedictus Suprapto. 2001. *Hakekat pembelajaran MIPA dan Kiat Pembelajaran Kimia di Perguruan Tinggi.* Jakarta: PAU-PPAI.

Friesen, Jhon W. 2012. The Deep Historical Roots of Inquiry Learning. *Jurnal Pendidikan Malaysia.* 37(1): 47-55

Gunawan, D., Utanto, Y., & Maretta, Y. A. (2017). An analysis on indonesian teachers' reasoning in resolving moral dilemmas. *Man In India*, *97*(2), 829-841.

Huda, Ajeng Khusnul. 2015. *Pengaruh Penerapan Metode Inkuiri Terhadap Kemampuan Berpikir Kritis dan Hasil Belajar Siswa SMA NU Al-Ma'ruf Kudus*. Skrips. Universitas Negeri Semarang.

Iksan, Zanaton & Esther Gnanamalar Sarojini Daniel. 2012. Penyoalan Lisan Guru dalam Proses Pengajaran bagi Tajuk Elektrokimia. *Jurnal Pendidikan Malaysia*. 37(1): 57-67

Iriany. 2009. *Model Pembelajaran Inkuiri Laboratorium Berbasis Teknologi Informasi Pada Konsep Laju Reaksi untuk Meningkatkan Keterampilan Generik Sains dan Berpikir Kreatif Siswa SMA*. Bandung: Sekolah Pasca Sarjana UPI.

Matthew, E. (2011). Investigative primary science: a problem-based learning approach. *Australian Journal of Teacher Education*. 36 (9) : 36-57.

Munawaroh & Fatmaryanti, S.D. 2016. *Pengaruh model pembelajaran inkuiri terbimbing terhadap keterampilan generik sains siswa SMA*. Skripsi. UM Purworejo.

Oppong, Nuako Juliet, Bruce M. Shore1, Katie S. Saunders-Stewart & Petra D. T. Gyles. 2015. Using Brief Teacher Interviews to Assess the Extent of Inquiry in Classrooms. *Journal of Advanced Academics*. 26(3): 197–226.

Parmin, Sajidan, Ashadi, Sutikno, & Maretta, Y. A. (2016). Preparing Prospective Teachers in Integrating Science and Local Wisdom through Practicing Open Inquiry. *Journal of Turkish Science Education*, *13*(2), 3-14.

Rimatusodik, Reva. 2010. *"Profil Keterampilan Generik Siswa SMP dalam Praktikum Kerusakan Lingkungan Menggunakan Kotak Erosi"*. Skripsi. Sarjana (S1) Pendidikan UPI Bandung, Bandung.

Rizal, Haryanti Putri & Muhammad Danial. 2014. Pengaruh Model Pembelajaran Inkuiri Terhadap Keterampilan Generik Sains Siswa Kelas XI IPA SMA Negeri 1 Pangkajene Sidrap. *Jurnal Bioedukasi Pendidikan Biologi*. 5(1): 1-8.

Rosidah, Tin, Andari Puji Astuti, & VDR Andri W. 2017. Eksplorasi Keterampilan Generik Sains Siswa pada Mata Pelajaran Kimia di SMA Negeri 9 Semarang. *Jurnal Pendidikan Sains (JPS)*. 5(2): 130-137.

S Sudarmin, & Haryani, S. (2015). The Ability Of Generic Science at Observation and Inference Logic Prospective Chemistry Teacher in Organic Chemistry Experiment. *International Journal Of science and Research* (IJSR). 4(5): 2319-7064.

S Sudarmin. 2012. *Keterampilan Generik Sains dan Penerapannya dalam Pembelajaran Kimia Organik*. Semarang: Unnes Press.

S Sudarmin. 2012. Meningkatkan Kemampuan Berpikir Tingkat Tinggi Mahasiswa melalui Pembelajaran Kimia Terintegrasi Kemampuan Generik Sains. *Varia Pendidikan* 24 (1): 97-103.

Samadin. 2012. *Penerapan Pembelajaran Inkuiri Model Silver untuk Mengembangkan Keterampilan Generik Sains Siswa Pada Konsep Sifat Koligatif Larutan. Bandung*: UIN Sunan Gunung Jati..

Sayak, Selly Marsela Ludovika. 2017. Keterampilan Generik Sains Siswa Sma Pada Praktikum Sifat Koligatif Larutan. *Jurnal Pendidikan Dan Pembelajaran*. 6(3): 1-10..

Septiani, Dwi. 2013. Efektivitas Model Inquiry Based Learning Berbantuan Modul Dalam Meningkatkan Pemahaman Konsep Dan Keterampilan Generik Sains Peserta didik. *Jurnal Inovasi Pendidikan Kimia*. 8 (2): 1340-1350.

Slameto. 1995. *Belajar dan Faktor Yang Mempengaruhinya*. Jakarta: Rineka Cipta.

Utanto, Y., Sukirman & Maretta. Y. A. (2017). Surviving in The Limitations: Education Implementation Patterns in Coast al Communities. *Man in India*, *97*(10), 163-175.

Utanto, Y., Widhanarto, G. P., & Maretta, Y. A. (2017, March). A web-based portfolio model as the students' final assignment: Dealing with the development of higher education trend. In *AIP Conference Proceedings* (Vol. 1818, No. 1, p. 020063). AIP Publishing.

Vebrianto, Rian & kamisah Osman. 2012. Keberkesanan Penggunaan Pelbagai Media Pengajaran dalam Meningkatkan Kemahiran Proses Sains dalam Kalangan Pelajar. *Jurnal Pendidikan Malaysia*. 37(1): 1-11.

Vebrianto, Rian dan Kamisah Osman. 2012. Keberkesanan Penggunaan Pelbagai Media Pengajaran dalam Meningkatkan Kemahiran Proses Sains dalam Kalangan Pelajar Jurnal Pendidikan Malaysia. 37(1): 1-11

Yulianingsih, U. & Hadisaputro, S. 2013. Keefektifan Pendekatan Student Centered Learning dengan Inkuiri Terbimbing untuk Meningkatkan Hasil Belajar. *Chemistry in Education*. 2(2): 149-55.