Authentic Problem Through Integrative Learning to Describe Scientific Activity Student Senior High School on The Physics Topic of Linear Motion

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ABSTRAK

Tujuan pembelajaran Fisika pada tingkat SMA diarahkan untuk melatihkan kerja ilmiah atau *scientific approach* siswa yang dapat diaplikasikan dalam kehidupan nyata. *Scientific approach* dapat membentuk karakter siswa melalui kerja ilmiah. Salah satu pembelajaran yang cocok dengan tujuan tersebut adalah *integrative learning*. Penelitian ini bertujuan untuk mendeskripsikan kerja ilmiah siswa setelah melalui pembelajaran *authentic problem* melalui *integrative learning*.

Penelitian ini merupakan penelitian kualitatif deskriptif pada topik gerak lurus. Data penelitian ini berupa pemaparan kerja ilmiah dan pelaksanaan pembelajaran diambil melalui observasi langsung dan disajikan secara deskriptif.

Hasil penelitian menunjukkan bahwa kerja ilmiah siswa yang dilatihkan dan proporsi siswa yang bisa mencapai kualitas baik adalah menggunakan alat dan bahan (69%), mengumpulkan data (73%), menganalisis data (61%), menyimpulkan (75%), dan mengkomunikasikan hasil eksperimen (77%).

Kata Kunci: *integrative learning*, kerja ilmiah

ABSTRACT

The objectives of physics learning at senior high school level are directed toward scientific activity that students can apply in real life. Scientific approach can form the character of the students through scientific activity. One that fits with the goal of learning is integrative learning. This research aimed to descriptive scientific activity of students after learning through authentic problem method in integrative learning.

This research is a qualitative-descriptive research on the topic of linear motion. This research data in the form of scientific activity and the implementation of learning is taken through direct observation and is presented descriptively.

The results showed that the trained scientific activity and the proportion of students who could achieve good quality on the use of tools and materials was 69%, on data collection was 73%, on data analysis was 61%, on conclusion drawing was 75%, and on communicating the results of the experiment was 77%.

Key words: integrative learning, scientific activity

INTRODUCTION

The learning objectives of Physics at the high school level are directed to form a positive attitude and scientific activity or scientific approach to the physics (Ullmer, 2011; Wieman, 2007; Wenning, 2011), developing thinking skills, and develop mastery of concepts to be used as a provision of higher education (Depdiknas, 2006). This is consistent with the nature of science / physics which is the science of natural phenomena that are poured in the form of facts, concepts, principles and laws are verified through scientific activities (Yuliati, 2008).

Scientific approach can form the character of students through scientific activity. Scientific activity ability can be developed in physics. The ability of the scientific activity is an activity that refers to the ways of scientists in studying the world and provide an explanation based on scientific facts (Wenning, 2007: 21). The ability of the scientific activity that is usually developed in physics education research include defining the problem, stating hypotheses, design experiments, collect and analyze data, evaluate or present the results of experiments, and conclude (Etkina et al, 2006; Karelina & Etkina, 2007).

Concepts in mechanics is the basis of science Physics others and most of the mechanics concepts associated with various physical phenomena in everyday (Sutopo, 2012). One of the most fundamental concepts of mechanics is linear motion (Serway and Jewett, 2004: 1). The concept of linear motion has many applications in the real world, but a lot of students who have misconceptions about speed, velocity, and acceleration (Hake, 1998; Reif & Allen, 1992; Ivowi, 1984; Arons, 1981; Shaffer & McDermott, 2005; Singh & Schunn, 2009; and Suparno, 2013).

Students should be able to apply the results of learning to solve problems in real life. Problems in the real context of urgently needed so that students are able to apply their knowledge in everyday. Barrows & Lynda (2007: 92-93) split into a few problems fictional, authentic, and real. Authentic problem is a problem that is based on the problems actually encountered in the workplace or real life, which is generally complex. Authentic problem is also effective to improve the ability of the scientific activity of students (Dux & Salim, 2012; Etkina et al, 2008). The ability of this scientific activity can resolve the issue through the learning process (Etkina et al, 2008; Etkina et al, 2009).

Authentic problem can be applied to learning that emphasizes the importance of students to connect concepts with real-life applications. One example of such learning is Integrative Learning (Peet et al, 2011; Shi, 2006). Integrative Learning can strengthen in-depth knowledge based on direct experience taken during the education process. Direct experience of students can be implanted through contextual material and related to everyday (Shi, 2006). According to Peet et al (2011) integrative learning is learning that helps students to integrate knowledge from different series of learning, applying the knowledge gained from one place to the new situation, as well as identifying or join the new knowledge of the students.

Stages of integrative learning as expressed Ritland (2002) covers exploration informed, enactment, the evaluation phase: local impact, and the evaluation phase: The broader impact. This stage is very suitable for melatihkan ability scientific activity and to improve students' understanding of the concept. In the enactment stage students can develop the skills of scientific work using tools such experiments, collect data, and analyze the data. At this stage of the evaluation phase: local impact the ability of the scientific activity that can be developed that communicate the results of experiments and concluded experimental results. While at this stage of the evaluation phase: local impact, and the evaluation phase: The broader impact students are required to develop the concept and expand their knowledge.

Education experts have a lot of research integrative learning. Integrative learning can provide meaningful experiences for students (Ruokonena & Ruismäki, 2012). Research conducted by Becker & Park (2011) showed an increase in student learning outcomes. Vasile (2011) states that are integrative approach to learning that is realized in the learning process can increase interest, attitudes, emotions and personality of students. Intergrative learning can also enhance spiritual development, so that the development of students' affective and spiritual awareness of students can be controlled (Ogden & Sias. 2010).

METHODS

This research is a qualitative-descriptive research. Of this research is intended to observe and obtain data or information to collect a variety of information on authentic learning through integrative learning problem for the scientific activity of Physics.

Instruments such as the ability of the scientific activity of observation rubric based indicators of the ability of the scientific activity is to use the tools and materials, collect data, analyze the data, conclude, and communicate the results of the experiment. Data collection instruments such as rubrics, field notes, and interview guides. Data collection techniques such as observation and interviews.

RESULTS AND DISCUSSION

The data comes from observational studies of scientific activity during the learning and interviews at the end of the study. Indicators of scientific activity used in this research is to use the tools and materials, collect data, analyze the data, conclude, and communicate the results of the experiment (Etkina et al, 2006; Karelina & Etkina, 2007). The results of this scientific activity is expressed in the form of numbers through observation during the learning process using the rubric of scientific activity (Karelina & Etkina, 2007).

1. Using the tools and materials

The percentage of students in the use of quality tools and materials can be seen in Table 1.6.

Table 1.6. Percentage of students using the tools and materials

Using the tools and materials	percentage (%)
Using the tools and materials but do not read the instructions, do not understand the function of the tool	22
Using the tools and materials, read the instructions but do not understand the function of the tool	47
Using the tool, read the instructions and understand the function of the tool	31

On indicators using tools and materials, it can be seen that 69% of students still do not understand the tool. This is due to many new students to know the tools used in the experiment linear motion. For example, the ticker timer. Meanwhile, the percentage is 31% of students who

are already conducting experiments linear motion and students also have learned previously that already understand the function of the appliance.

2. Collect data

Percentage of students in collecting data quality can be seen in Table 1.7.

Table 1.7. Percentage of students collect data

Collect data	percentage (%)
The data collected is not complete and the students do not understand the meaning of data taken	18
The data collected is complete, but the students do not understand the meaning of data taken	44
The data collected is complete and students understand the meaning of data taken	38

The second indicator is to collect the data. As many as 44% of students from 15 students have collected complete data, but the students do not understand the meaning of the captured data. Based on interviews and observations they just follow orders contained in worksheets and "join in" her in collecting the data. While 38% of students have understood the meaning of the data that is retrieved and the data collected complete.

3. Analyze the data

Percentage of students in analyzing the quality of the data is shown in Table 1.8.

Table 1.8. Percentage of students analyze the data

Analyze the data	percentage (%)
Shows the relationship of variables and determine the equation based on the chart, but both are wrong	30
Variable based on the graph shows the relationship properly but one of determining equation based graphs	55
Shows the relationship of variables and determine the equation based graphs correctly	15

In analyzing the data indicator, students seem to have an average value of the least be compared other indicators. This is evidenced by the results of interviews with students that during this learning takes place very rarely requires students to analyze the data. Therefore, it should be a scientific activity needs to be applied and in learning physics. Scientific activity consists of skills and hands-on minds-on or mental process, so that this ability does not come automatically but need to exercise (Wenning, 2007: 22).

4. Conclude

The percentage of students in the concluding quality can be seen in Table 1.9.

Table 1.9. Percentage of students concluded

Conclude	percentage (%)
Concludes that based on the analysis of data and not in accordance with the theory	17
Concluded based on the results of data analysis but not in accordance with the theory	37
Concluded based on the analysis of data and in accordance with the theory	46

In concluding indicator teacher helped students by giving scaffold. Relief is due at the first meeting of the students are very difficult to analyze the data. Scaffolding is a process for a student who assisted teachers or people who are better able to cope with problems or mastering skills slightly above the current level of development (Arends, 2012). According Handayanto (2012), scaffolding affect students both cognitively and emotionally, impacting not only the knowledge and skills of students, but also students' motivation and confidence in the face of the task.

5. Communicate the results of the experiment

Percentage of students in communicating the quality of experimental results can be seen in Table 1.10.

Table 1.10. Percentage of students communicate the results of experiments

Communicate the results of the experiment	percentage (%)
Communicate the results of experiments (data, graphics, explanations) does not fit the concept, and are described brief	10
Communicate the results of experiments (data, graphics, explanations) according to the concept, and are described brief	49
Communicate the results of experiments (data, graphics, explanations) according to the concept, and described in detail (important matters submitted)	41

Last indicator that communicates the results of the experiment. Based on the average value of the scientific activity of students, this indicator has the highest value. This is reinforced by the results of interviews and direct observation during the learning that students are often trained presentation or express opinions on the subjects of physics or other subjects. So, during a given intervention students were fluent in communicating with friends group or any other group.

However there are 49% who briefly explain the experimental results (data, graphics, explanations) corresponding concepts. While 41% has been explained in detail (important matters submitted).

CONCLUSION

Based on the results of research and discussion described, it can be concluded 1) Scientific activity students who trained and the proportion of students who can achieve good quality is to use the tools and materials (69%), collect the data (73%), analyze the data (61%), concluded (75%), and communicate the results of the experiment (77%). 2) Learning authentic problem through integrative learning is applied in this study has the characteristic: "students to solve authentic problems through discussion and practice; evaluation includes self-evaluation, evaluation and teacher evaluation friends ".

REFERENCES

Arends, R. I. 2012. *Learning to Teach:* 9th edition. New York: McGraw-Hill.

Arons, A. 1981. Thinking, Reasoning and Understanding In Introductory Physics Courses. *The Physics Teacher*, 19. 166-172

Barrows, H.S. & Lynda, W.K.N. 2007. *Principles and Practice of aPBL*. Jurong: Pearson Prentice Hall

Becker, K & Park, K. 2011. Effects of integrative approaches among science technology, engineering, and mathematics (STEM) subjects on students' learning: A preliminary meta-analysis. *Journal of STEM Education*, (online), 12(5&6), 23-37., diakses 25 Maret 2013

Depdiknas.2006. Permen Diknas No. 22. *Kurikulum Fisika (Standar Isi)*. Jakarta:Depdiknas.

Dux, H.A.D & Salim, W.W.A.W. 2012. Transforming the First-Year Engineering Experience through Authentic Problem-Solving: Taking a Models and Modeling Perspective. *Sciencedirect Procedia Social and Behavioral Sciences* , (Online), 56(2012) : 314 – 332, (www.sciencedirect.com), diakses 27 Januari 2013

Etkina, E., Van Heuvelen, A., White-Brahmia, S., Brookes, D.T., Gentile, M., Murthy, S., Rosengrant,D.,& Warren,. A. 2006. Scientific abilities and their assessment. *Physics Education Research*, 2(2) : 1-15

Etkina, E; Karelina, A & Villasenor, M.R. 2008. How long does it take? A study of student acquisition of scientific abilities. *Physics Education Research* 4(2) 1-15

Etkina,E; Karelina,A; Murthy,S; & Villasenor, M.R. 2009. Using action research to improve learning and formative assessment to conduct research *Physics Education Research*, 5(1); 1-15

Hake, R.R. 1998. "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses". *American Journal of Physics.* 66, (1), 64–74

Handayanto, S.K. 2012. *Pengaruh Strategi Scaffolding-Kooperatif Dan Pengetahuan Awal Terhadap Prestasi Belajar Dan Sikap Pada Mata Kuliah Fisika Dasar.* Disertasi tidak diterbitkan. Malang: PPS UM

Ivowi, U.M.O. 1984. Misconceptions In Physics Amongst Nigerian Secondary School Students. *Physics Education*, 19, 279-285

Karelina, A & Etkina, E.2007 Acting like a physicist: Student approach study to experimental design. *Physics Education Research* 3(2);1-12

Ogden,K.R.W., & Sias, S.M., 2010. An integrative spiritual development model of supervision for counselors-in-training, *Ideas and Research You Can Use: VISTAS 2010 ,(online),* Article 44, (http://counselingoutfitters.com/vistas/vistas10/Article_44.pdf), diakses 27 Maret 2013

Peet, M., Lonn, S., Gurin, P., Boyer, K.P., Matney, M., Marra, T., Taylor, S.H., & Daley, A. 2011. Fostering Integrative Knowledge through ePortfolios. *International Journal of ePortfolio*, (Online), 1 (1) 11-31, (www.theijep.com), diakses 17 April 2013.

Reif, F. and Allen, S.1992. "Cognition for interpreting scientific concepts: A study of acceleration". *Cognition and Instruction*. 9, (1), 1–44.

Ritland, B.B., 2003. The Role of Design in Research: The Integrative Learning Design Framework. *Educational Researcher*, (online), 32 (1), 21–24. (www.eric.ed), diakses 13 Maret 2013

Ruokonena, I & Ruismäki, H., 2012. Learning Circus skills in a day care centre: Student teachers in a cooperative, integrative arts education project. *Procedia Social and Behavioral Sciences*, (Online), 69 (2012) 1443 – 1451. (http://www.sciencedirect.com), diakses 25 Maret 2013.

Serway, R. A. & Jewett, J. W. 2004. *Physics for Scientists and Engineers, Sixth Edition*. Pomona: Thomson Brooks/Cole

Shaffer, P.S. and McDermott, L.C. 2005. "A research –based approach to improving students understanding of vector nature of kinematical concepts". *American Journal of Physics.* 73, (10), 921–931.

Shi, D.E. 2006. *Technology and Integrative Learning: Enabling Serendipitous Connectivity across Courses*. Washington : AAC&U, (online), (http://www.aacu.org), diakses 26 april 2013

Singh, C., & Schunn, C.D. 2009. Connecting Three Pivotal Concepts in K-12 Science State Standards and Maps of Conceptual Growth to Research in Physics Education. *Journal of Physics Teacher Education,* (Online), 5(2): 16-42, (www.phy.ilstu.edu/jpteo), diakses 19 Januari 2013

Suparno, P. 2013. *Miskonsepsi & Perubahan Konsep Dalam Pendidikan Fisika.* Jakarta : PT. Grasindo

Sutopo. 2012 .*The Use Of Representational Approach To Improve Students' Learning In Mechanics In Selected Topics Of The School Physics Course.* Disertasi tidak diterbitkan. Bandung: PPS UPI

Ullmer, J.H.2011. The scientific method of Sir William Petty. *Erasmus Journal for Philosophy and Economics*. (online), 4(2) 1-19. (http://ejpe.org/pdf/4-2-art-1.pdf), diakses 28 April 2014

Vasile, C. 2011. Entry points, interests and attitudes. An integrative approach of Learning. *Sciencedirect Procedia Social and Behavioral Sciences* , (Online), 11 (2011) 77–81, (www.sciencedirect.com), diakses 25 Maret 2013

Wieman,C. 2007.Why Not Try? a Scientific Approach to Science Education?. *Change Magazine*. (online), 39(5) 9-15, (*www.cwsei.ubc.ca/SEI_research/.../Wieman-Change_Sept-Oct_2007.pdf*), diakses 23 April 2014

Wenning, C. J .2007. Assessing Inquiry Skill as a Component Of Scientific Literacy. *Journal Physics Teacher Education Online*, (online) , 4(2) : 21-24, (http://www.jpteo.com), diakses 27 Maret 2013

Wenning, C. J. 2011. Experimental Inquiry in Introductory Physics Courses. *Journal Physics Teacher Education Online*, (Online), 6(2): 2-8, (http://www.jpteo.com), diakses tanggal 27 Maret 2013

Yuliati, L. 2008. *Model-model Pembelajaran Fisika: Teori dan Praktek*. Malang: Lembaga Pengembangan dan Pembelajaran UM.