
Effectiveness of Integrated Science Learning Materials of Waves in Life by Integrating Digital Age Literacy on Grade VIII Students

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ABSTRACT

Literacy skills are important for an educational graduate in 21st century. Integrated science learning is a good method to develop the literacy skills of students. For this reason the 2013 curriculum requires science learning is implemented in integrated pattern. Besides that, ministry of Education and Culture also develop the school literacy movement to improve literacy of students. However, integrated science learning and integrating literacy in learning can't be implemented well. An alternative solution to solve this problem is to use integrated science learning material by integrating digital age literacy. The objective of the research is to investigate the effectiveness of integrated science learning material by integrating digital age literacy in scientific approach to improve the competence of grade VIII students in Junior High School. This research is a part of research and development. The research design which used in preliminary field testing was before and after treatment. Instruments to collect the data in this research consist of three parts namely attitude observation sheet, performance assessment sheet, and learning outcome test sheet. The research data were analyzed by using descriptive statistics analysis, normality and homogeneity test, and paired comparison test. From the data analysis result it can be stated that the use of integrated science learning materials on waves in life theme by integrating digital age literacy is effective in scientific approach to improve three aspects of student's competences those are knowledge, attitude and literacy skills.

Keywords: Integrated science, Learning materials, Waves, Literacy

Introduction

An educational graduate needs to have good skills in dealing with the 21st century. Partnerships for 21st century skills has grouped skills into three types namely: learning, literacy and life skills (Maximus, 2014). In science education, there are some 21st century skills which need to be gained such as digital age literacy, exploratory thinking, effective communication and high productivity (Ersin, 2017). Thus education should be able to develop the skills of graduates so that they can compete and solve the problem in this century.

Education minister of Indonesia has changed the curriculum to produce graduates which

relevant with the 21st century. The 2013 curriculum in Indonesia requires science learning is implemented in an integrated patters. Science in junior high school should be developed as a subject in integrated science pattern (Yuni, 2014) and (Wiyanto, 2016). Science subject is based on integrated concepts from various sub disciplines of science. The content of science comes from the sub disciplines of biology, physics, and chemistry. The concept of integration is shown in core competencies and basic competencies. In one basic competence has integrated the science concepts of sub disciplines of biology, physics, chemistry, and earth and space science (Tika, 2014).

Integrated science learning has become a central issue in 2013 curriculum (Siti, 2017).

Drake (2004) states that integrated science integrates the perspectives of sub disciplines such as biology, chemistry, physics, and earth/space science. On the other hand Yuni (2014) also explains that integrated science covers the aspects of physics, chemistry, biology, geography, astronomy, as well as other aspects of the study of nature. This means integrated science is a learning approach which connects among sub disciplines of science to make learning more authentic, holistic, meaningful, and active (Rahmania, 2017).

Besides developing the 2013 curriculum, the ministry of education and culture also encourages the school literacy movement. This activity is conducted to foster interest of students in reading, to improve reading skills so that they can understand the knowledge well. In this case, literacy is important for students in knowing, understanding, and applying the knowledge which is obtained them in school. Besides that literacy also related to the life of students both at their home and in their surrounding environment. This literacy activity in school is more focused on reading literacy.

In traditional meaning literacy is the ability to read and write, listen and speak and enumerate (Eno, 2011). In modern context the meaning of literacy develop based on the ability in certain field. Salika (2013) defines that literacy skills are the ability to identify, understand, interpret, create, communicate, compute, and use printed and written materials associated with varying contexts. On the other hand Hanna (2012) also argues that literacy is also the ability to make and to communicate meaning from a variety of contextual symbols. Literacy skills are important for students in education process

because literacy can help them in learning and in daily life.

In education both integrated science learning and literacy skills are important in schools. But the real conditions in school aren't match with ideal conditions. The first reality is teachers still remain science as separated subjects of chemistry, physics and biology (Indriani, 2013 and Ardianto, 2016). The second reality is learning materials of biology, physics and chemistry in integrated science textbooks is still separated (Asrizal, 2017). This result is confirmed by Rahmania (2017) which finds that the teaching materials used by the teacher remain in separate material form without relation to the others. Third reality is the functional literacy, scientific literacy, and visual literacy of grade VIII students in Padang city is still low with an average value of 42.92 (Asrizal, 2017).

The presence of this gap indicates that there is a research problem to be solved. As an alternative solution of this problem is to develop the integrated science learning materials on waves in life by integrating digital age literacy. Mei (2017) states that learning materials can be defined as all kinds of materials used by teachers to implement teaching and learning activities. Main while Abadi (2017) defines that learning materials are all kinds of materials that are used to assist educators in implementing the teaching and learning activities in the classroom. Abdu (2016) also explains that learning materials are essential and significant tools needed for teaching and learning of school subjects to promote teacher's efficiency and improve student's performance. From both these definitions it can be argued that learning materials are essential for implementing learning to improve activities of students.

The use of learning materials play an important role in the learning process. One important point in this case, learning materials

make learning more interesting, practical, realistic and appealing. They also enable both the teachers and students to participate actively and effectively in lesson sessions (Abdu, 2016). Function of learning materials are as learning materials for students and teacher, as main source in content materials, as specific idea about fundamental properties of scientific learning, as materials to develop the science, and as main direction to arrange teacher's strategy in science learning. Learning process which uses learning materials can improve cognitive value, skills and affective value of students (Rita, 2017).

Wave is usually explained as one topics of Physics science. Reality shows that waves are everywhere. In other words, many wave phenomena are found in everyday life. For example, water wave, sound wave and light. The earthquake and tsunami become central issue in Indonesia. These describe the wave phenomena in human life. A wave is a disturbance that carries energy through matter or space (Paul, 2005). In general, the waves can be divided into two parts, namely mechanical waves and electromagnetic waves. A mechanical wave travels as energy is transferred from particle to particle in the medium (Glencoe, 2008). Meanwhile an electromagnetic wave is a wave that can travel through empty space or through matter and is produced by charged particles that are in motion (Glencoe, 2008).

The concept of wave is used in everyday human life and technology. From this reason learning material of waves should be discussed in an integrated pattern for grade VIII students. In the 2013 curriculum in Indonesia integrated waves material has described on basic competencies such as applying the concept of waves and sounds in everyday life and sonar systems in animals. In addition, the characteristics of light and

shadow formation have been connected with the process of human vision and insect eyes.

The application of integrated science learning materials needs to be done to solve this research problem. Application of this learning materials is important to realize the integrated learning science, to create the context of science learning materials, and to develop the literacy skill of students. From this reason, researcher is interested to conduct this research. The purpose of this research is to investigate the effectiveness of the use of integrated science learning materials to improve the cognitive competence, attitude competence and literacy skills of grade VIII students in junior high school.

Methodology

Type of this research is research and development or R&D. R & D is a research method which used to create a certain product, and to test the effectiveness of that product. Development model which is used in this research is Sugiyono model. In this research is done seven stages from ten stages of development model. Stages of this research are to understand the potency and problem, to collect the data, to design the product, to validate the product, to revise the product, to do preliminary field testing, and to revise product after this testing.

Research design in preliminary field testing activities is before and after treatment for one sample group. In this case, preliminary field testing is done to determine the effectiveness the use of integrated science learning material by integrating digital age literacy. In this field testing activity involves 32 students of grade VIII in SMPN 12 Padang. Before using the integrated science learning material was applied the scientific approach for two meetings. After that integrated science learning material by integrating digital age

literacy was applied in scientific approach for three meetings.

Instruments to collect data are observation sheet of attitudes, cognitive competence test sheet and performance assessment sheet. Observation sheet is required to assess the attitudes of students in learning process. Cognitive competence test is used to obtain student knowledge data before and after using integrated science learning material. On the other hand the performance assessment sheet is important to assess literacy skills of students including functional literacy, scientific literacy and visual literacy.

Data of research result were analyzed by descriptive statistics analysis, normality and homogeneity test, and paired comparison test. Descriptive statistics analysis is used to give information about a data group such as cognitive, attitudes, and literacy skills of students. Parameters of statistical descriptive analysis include minimum value, maximum value, range, mean value, median, mode, and standard deviation. The effectiveness of the use of integrated science learning by integrating digital age literacy on waves in life can be seen on three aspects of student's competences. Normality test is used to determine a group data is normally distributed data. Homogeneity test is used to determine a group data has same variance. The paired comparison test is used to determine the difference in mean value of knowledge, attitudes and literacy skills of students. Literacy skills which are assessed in this research are functional literacy, scientific literacy, and visual literacy of students in scientific approach.

Result and Discussion

In general there are three results from this research. The first result of research is the effectiveness of the use of integrated science

learning materials to improve knowledge competence of students. Effectiveness is determined by comparing posttest result with pretest result. The values of descriptive statistical parameters of pretest and posttest for 32 students can be seen in Table 1

Table 1. Value of Descriptive Statistics of Knowledge Competence

No	Parameter Value	Pretest	Posttest
1	Minimum	25.0	65.0
2	Maximum	75.0	100.0
3	Mean	49.7	81.7
4	Median	50.0	80.0
5	Std. Deviation	11.9	8.3
6	Variance	143.4	68.7

The mean and standard deviation in Table 1 of pretest result are respectively 49.7 and 11.9. On the other hand the mean and standard deviation values of the posttest are respectively 81.7 and 8.3. In this case, the average value of posttest is higher than pretest value. From the normality test the group of pretest data is normally distributed while the data group of posttest is not normally distributed. Meanwhile, from F test, it is known that both group data of pretest and posttest don't have the same variant.

Based on the data characteristics of pretest and posttest, nonparametric statistical test is used to determine differences in knowledge competence of students after and before using the integrated science materials. The comparison test which used is Wilcoxon paired comparison test. This comparison test is also called as Wilcoxon signed rank test. From the Wilcoxon test is obtained the calculated Z value is -4.96. For the two-tails of comparison test, the value of the area under the standard normal curve F(z) is 0.475. The value of Z in the table for significant value α

= 0.05 and this area is 1.9. In other word the value of Z in table is 1.9. This means that value of calculated Z value is outside of the acceptance area of null hypothesis. This result indicates that there is a significant difference between cognitive competence of students after using integrated science learning material with before use it. Thus the use of integrated science learning material of waves in life theme by integrating digital age literacy is effective to improve knowledge competence of grade VIII students in Junior High School.

The second result of this research is the effectiveness of the use of integrated science learning material by integrating digital age literacy to improve attitudes competence of students. Before using the integrated science learning material, attitudes competency of students were observed for two meetings. Attitude of students which were observed in learning process consist of six types namely confident, curiosity, communicative, discip line, responsible and hard work. After using the integrated science learning material the attitudes competence of students also were observed for three meetings. The results of student’s attitudes competence before and after using integrated science learning material can be displayed in Table 2.

Table 2. Value of Descriptive Statistics of Attitudes Competence

No	Parameters Value	Before	After
1	Minimum	50.0	73.6
2	Maximum	70.8	90.3
3	Mean	62.8	78.5
4	Median	62.5	76.4
5	Std. Deviation	6.1	4.3
6	Variance	37.4	18.5

From the data in Table 2 it can be explained that the average value of student’s attitudes

competence before using integrated science learning material is 62.8 whereas the average value of student’s attitudes after using it is 78.5. The average value the attitudes competence of students after using the integrated science learning material is higher than before using it.

From the normality test, the attitudes data group of students both before and after using integrated science learning material aren’t normally distributed. Meanwhile from the F test it is known that the two data groups of students come from the same variance. Based on the characteristics of this data groups, it can be used Wilcoxon paired comparison test.

The Z value of the Wilcoxon paired comparison test is -4.94. On the other hand the value of Z in the table for significant level of $\alpha = 0.05$ and for the area under standard normal curve of $F(z) = 0.475$ is 1.9. It means that the value of calculated Z is outside the acceptance area of null hypothesis. From the result of Wilcoxon paired comparison test can be stated that there is a significant difference in attitudes competence of students between after using integrated science learning material with before using it. Therefore, as the conclusion of this test is the use of integrated science learning material on waves in life theme by integrating digital age literacy is effective to improve the attitudes competence of grade VIII students in Junior High School.

The third result of this research is the effectiveness of the use of integrated science learning material on waves in life theme by integrating digital age literacy to improve the skill competence of students. In this case, skills of students are seen from the three parts of the digital age literacy. Parts of digital age literacy are functional literacy, scientific literacy, and visual literacy. The value of the three digital age literacy parts before and after using the integrated science learning material is shown in Figure 1

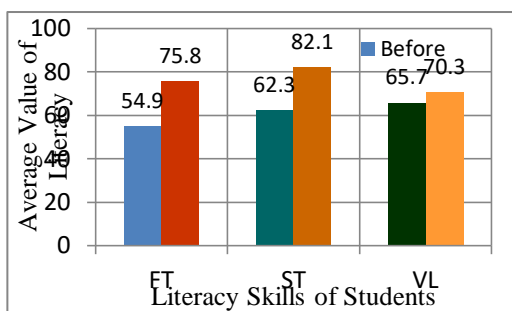


Figure 1. Average Value of Literacy Skills

Average value of functional literacy of students both before and after using integrated science learning materials are respectively 54.9 and 75.8. The average value of scientific literacy of students both before and after using integrated science learning materials are respectively 62.3 and 82.1. Meanwhile, average value the visual literacy of students both before and after the using science learning material are respectively 65.7 and 70.3. These data indicate that the average value of functional literacy, scientific literacy and visual literacy of students after using the integrated science learning material is higher than before using it.

From the characteristics of these third data groups the literacy skills of students then it is used Wilcoxon paired comparison test. At a 95% confidence level, the value of calculated Z for functional literacy, scientific literacy, and visual literacy are respectively -4,939, -4,937 and -4,942. In other words the Z value of these three literacy skills is -4.94. On the other hand the value of Z in the table for the significant level of $\alpha = 0.05$ with the area under standard normal curve of F (z) 0.475 is 1.9. From these two Z values it can be explained that the Z values of functional literacy, scientific literacy, and visual literacy are outside the acceptance area of the null hypothesis. This means the use of integrated science learning material has a significant effect to improve literacy skills of students.

Therefore the use of integrated science learning material of the wave in life theme by integrating digital age literacy is effective to improve the skills of functional literacy, scientific literacy, and visual literacy of grade VIII students in Junior High School.

The use of integrated science learning material on waves in life theme by integrating digital age literacy is effective to improve the competences of students including knowledge competence, attitudes competence and literacy skills competence. It means that integrated science learning by integrating digital age literacy gives positive effect on competences of students. This result is suitable research result of Mei (2017) which concluded that it means that the teaching materials developed can improve student learning outcomes. The use of integrated science learning material can encourage student’s involvement in learning, practice literacy skills of students, motivate the students in learning by exploring the real-world contexts, and practice the students in problem solving of science. In this case literacy skills are very important to help students in their learning and their daily life. For this reason, science teachers and students can use this integrated science learning material as an alternative of science learning sources on grade VIII students.

In the development and the use of integrated science learning material by integrating digital age literacy are still found some limitations. The first limitation is integrated learning model which used in science learning material is webbed model. In the sub theme of webbed model is used a connected model that connects a sub science discipline concept with other sub disciplines of science. As the development of this research can be done other integrated learning models which proposed by Fogarty. According Fogarty there are ten models of integrated learning. The second limitation is the theme in integrated

science learning material only the waves in life for basic competence of vibration, sound, and light. As an alternative solution of this limitation is to develop the other themes based on basic competence of science. The last limitation is the type of digital age literacy. In this research only three types of digital age literacy which integrated into science learning material those are functional literacy, scientific literacy, and visual literacy. Other types of digital age literacy can be integrated into science learning material because this literacy consist of seven parts namely functional, scientific, technological, visual, information, cultural and global awareness literacy.

Conclusion

Based on the data analysis it can be presented three results of this research. First result of this research is the use of integrated science learning material on waves in life theme is effective to improve the knowledge competence of grade VIII students at significant confidence 95 %. Second result of this research is the use of integrated science learning material on waves in life theme is effective to improve the attitudes competence of grade VIII students. The attitudes competence of student including: confidence, curiosity, communicative, discipline, responsibility and hard work. As last result of this research is the use of integrated science learning material on the waves in life theme is also effective to improve the literacy skills of grade VIII students covering functional literacy, scientific literacy, and visual literacy at the same confidence level.

References

- Abdu-Raheem Bilqees Olayinka, 2016, Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria, *World Journal of Education*, Vol. 6, No. 1
- Ardiani Mustikasari, 2017, Integrated Science Learning with Theme of the Favorite Fashion on Junior High School, 4th ICRIEMS Proceedings Published by The Faculty Of Mathematics and Natural Sciences Yogyakarta State University
- Ardianto D and Rubini B, 2016, Comparison of Students Scientific Literacy in Integrated Science Learning Through Model of Guided Discovery and Problem Based Learning, *Indonesia Journal of Science Education*, JPPI 5 (1), 31-37
- Arifin, A. Sjaiful, 2016, The Development of Air-Theme Integrated Science Teaching Material Using Four Steps Teaching Material Development, *Jurnal Pendidikan an Fisika Indonesia* 12 (1), 8-18
- Asrizal, et all, 2017, Development of Integrated Science Teaching Material of Our Digestive System Health by Integrating Scientific Literacy for Grade Students. *Proceeding International Conference on Global V*, Volume 1A, p 491-504.
- Asrizal, et all, 2017, Need Analysis to Develop the Adaptive Contextual Learning Model of Integrated Science by Integrating Digital Age Literacy for Grade VIII Students. *International Conference on Teacher Education (ICTE)*. Faculty of Education and Teacher Training, Riau.
- Eno Edem, et all, 2011. Literacy in Primary and Secondary Education in Nigeria, *Journal of Language and Culture* Vol. 2 (2), pp.15-19
- Ersin Karademir, Ufuk Ulucinar, 2017, Examining the Relationship between Middle School Students' Critical Reading Skills, Science Literacy Skills

- and Attitudes: A Structural Equation Modeling, *Journal of Education in Science, Environment and Health*, Volume 3, Issue 1
- Glencoe, 2008, *Introduction to Physical Science*, McGraw-Hill Companies, the United States of America
- Indriani Dwi Pursitasari, Siti Nuryanti, Amran Rede, 2015. Promoting of Thematic-based Integrated Science Learning on the Junior High School, *Journal of Education and Practice*, Vol.6, No.20: 97-101
- Luh Sukariasih. 2017. Development of Integrated Natural Science Teaching Materials Webbed Type with Applying Discourse Analysis on Students Grade VIII in Physics Class. The 5th International Conference on Theoretical and Applied Physics. IOP Conf. Series: *Journal of Physics: Conf. Series* 846, 012028
- Maximus Gorky Sembiring, 2014, Modeling Factors Affecting the 21st Century Skills Viewed by Indonesian Teachers, *ASEAN Journal of Open Distance Learning*, Vol. 6, No. 1
- Mei Wulan Kurniawati, 2017, Developing Learning Science Teaching Materials Based on Scientific to Improve Students Learning Outcomes in Elementary School, *European Journal of Education Studies*, Volume 3, Issue 4
- M K Abadi, H Pujiastuti and L D Assaat, 2017, Development of Teaching Materials Based Interactive Scientific Approach towards the Concept of Social Arithmetic for Junior High School Student, *Journal of Physics: Conference Series* 812
- Paul W. Zitzewitz, 2005, *Physics Principles and Problems*, The McGraw-Hill Companies, Inc, the USA
- Rahmania, Fitriani A, and Kaniawati I, 2017, Role of Integrated Sciences Teaching Materials on Pressure Topic to Improve Student's Critical Thinking Skills in Junior. *Asian Journal of Education and e-Learning*, Volume 05, Issue 02
- Rita Yenni, 2017, The Implementation of Integrated Science Teaching Materials Based Socio-Scientific Issues to Improve Students Scientific Literacy for Environmental Pollution Theme, *Mathematics, Science, and Computer Science Education (MSCEIS 2016) AIP Conf. Proc.* 1848
- Siti Nurul Izzah, et all, 2017, Implementation of the Interdisciplinary Integrated Science Learning Through Water Rocket Project, 4th ICRIEMS Proceedings Published by The Faculty Of Mathematics And Natural Sciences Yogyakarta State University
- Susan M. Drake and Rebecca C. Burns, 2004. Meeting Standards Through Integrated Curriculum. Association for Supervision and Development Alexandria, Virginia USA
- Tika Resti Pratiwi, 2016, Using Integrated Type on Science Learning for Improving Junior High School Students' Critical Thinking Skills, *Jurnal Pendidikan Fisika Indonesia* 12 (1), 54-64
- Wiyanto and Arif Widiyatmoko, 2016, Preparation Model of Student Teacher Candidate in Developing Integrative Science Learning, *Journal of Education and Human Development* June 2016, Vol. 5, No. 2, pp. 169-177
- Yuni Pantiwati, 2014, Triple Approach Instruction to Improve Learning Process and Outcome of Integrated Science Subject, *Journal of Education and Practice*, Vol.5, No.38