

Effectiveness of Adaptive Contextual Learning Model of Integrated Science by Integrating Digital Age Literacy on Grade VIII Students

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Abstract. Educational graduates should have good competencies to compete in the 21st century. Integrated learning is a good way to develop competence of students in this century. Besides that, literacy skills are very important for students to get success in their learning and daily life. For this reason, integrated science learning and literacy skills are important in 2013 curriculum. However, integrated science learning and integration of literacy in learning can't be implemented well. Solution of this problem is to develop adaptive contextual learning model by integrating digital age literacy. The purpose of the research is to determine the effectiveness of adaptive contextual learning model to improve competence of grade VIII students in junior high school. This research is a part of the research and development or R&D. Research design which used in limited field testing was before and after treatment. The research instruments consist of three parts namely test sheet of learning outcome for assessing knowledge competence, observation sheet for assessing attitudes, and performance sheet for assessing skills of students. Data of student's competence were analyzed by three kinds of analysis, namely descriptive statistics, normality test and homogeneity test, and paired comparison test. From the data analysis result, it can be stated that the implementation of adaptive contextual learning model of integrated science by integrating digital age literacy is effective to improve the knowledge, attitude, and literacy skills competences of grade VIII students in junior high school at 95% confidence level.

1. Introduction

Educational graduates should have good competence to exist in the 21st century. For this reason, education requires preparing and creating the graduates with abilities required to compete in the 21st century. There are four skills which required by education graduates in the 21st century namely ways of thinking, ways of working, tools for working, and skills for living in the world [1]. Therefore, education needs to create and to develop fourth these skills in learning.

Literacy skills are very important for students in the 21st century because of these literacy skills are able to influence their success in learning and their daily life. In other word, literacy is one of the most important foundations for success in school and life [2]. Good literacy skills will help students in



discovering and understanding various sources of learning such as oral, written, and visual text. The ability to find and to understand which relevant learning resources is very important in their learning process and their life. For this reason the development of student literacy in learning needs to be done. The development of literacy skills are necessity for preparing students in improving and widening their content knowledge and concepts which give support to other domains of life [3]. So, literacy skills of students are very important in education.

The integration of the curriculum is a way to develop skills of students in the 21st century. Curriculum integration is often seen as a way to effectively approach 21st century learning. Integrated curriculum seems like a perfect fit for developing generic 21st century competencies such as collaboration, creativity, communication, character education, literacy and critical thinking. More importantly, students are more engaged in school when they are learning in an interdisciplinary environment [4]. The existence of integration in the curriculum makes learning material is close to the real world situation. Thus, this integration is relevant to science because the essence of nature which found in daily life is integrated patter.

Science learning in the 2013 curriculum should be conducted in an integrated patter. The learning content in junior high schools which based on integrated concepts from various disciplines for educational purposes is the science subject. In essence, science is developed as a subject in integrated science. The content of science comes from the sub disciplines of biology, physics, and chemistry [5]. The concept of integration is shown in the core competence and basic competence. In one basic competence has integrated the science concepts from sub disciplines of biology, physics, chemistry, and earth and space science.

However, integrated science learning and integration of literacy in learning can't be implemented well in junior high school. These real conditions were found from the preliminary research which has been done before developing this learning model. There were three activities in the preliminary research include analyzing the implementation of science learning in schools, analyzing the learning materials in integrated science textbooks, and analyzing the result of student literacy skills. Hence, the results of this preliminary research were important for designing and developing the adaptive contextual learning model.

The first result of this preliminary research was the description of the implementation of science learning in the classroom. Instrument in observation activity was observation sheet of science learning in the classroom. The data analysis data indicates that the average value of the contextual learning strategy element is 48.3. It means that the implementation of contextual in science learning can be classified into low category. In addition, data analysis also shows that the value of integration of science material in learning process was 37.5. This average value indicates that the integration of science materials in learning was low [6]. Thus, the integration both contextual learning and learning materials in science learning process can be classified into low category.

The second result of the preliminary research relates to the description of learning material content of ten integrated science textbooks for grade VIII students in junior high school. Instrument to collect the data was a document analysis sheet. The analysis was done for each chapter of the integrated science textbooks. The result of analysis was percentage of learning materials of biology, physics and chemistry respectively 40.0%, 35.6% and 21.1%. The percentage of integrated science was only 3.3%. This integrated science materials was only found in science books in the 2013 curriculum. These results indicate that the integration of learning materials in integrated science textbooks was low [7]. Thus, learning material in integrated science textbooks was still separated in sub-discipline of science namely biology, physics and chemistry.

The last result of the preliminary research refers to the description of digital age literacy skills of students. Instrument to collect the data was literacy test sheet. Digital age literacy consists of functional literacy, scientific literacy, and visual literacy. The digital age literacy test was given to three classes of students from three schools in Padang. The average value of student's literacy from each of state junior high school respectively 39.89, 46.99 and 41.89. The average value of digital age literacy of these schools was 42.92. Therefore, this average value can be entered into low category [6].

The actual conditions which found didn't match with the expected conditions. This gap indicates a problem to be investigated. An alternative solution of this problem is to implement the adaptive contextual learning model of integrated science by integrating digital age literacy on grade VIII students. There are four theoretical review which related to the solution of this research problem those are: learning model, contextual learning, integrated science, and digital age literacy.

Learning model is a conceptual framework that can be used as a guide by teachers in learning. An instructional model as a plan or patter that can used to shape curriculum, to design to instructional materials, and to guide instruction in the classroom and other settings [8]. On the other hand, model of teaching can be defined as instructional design which describes the process of specifying and producing particular environmental situations which cause the student to interact in such a way that a specific change occurs in their behavior. It consists guidelines for designing educational activities and environment. Thus, the function of teaching model is to shape a curriculum, to design the learning materials, to guide learning in classroom, and to create learning situations [9].

Adaptive contextual learning model is a combination of contextual learning and learning model. Contextual learning is the learning which associated with the real world. Contextual learning is a concept that helps teachers relate school learning to real-world situations. It motivates learners to take charge of their own learning and to make connections between knowledge and its application [10]. Contextual learning is considered as an instructional method that engages students in a learning process by connecting the learning tasks with real-life situation issues or with contexts that guide them to seek meanings [11]. From these definitions, adaptive contextual learning model can be defined as a pattern which can be used by teachers to design instructional materials and to guide learning in the classroom and to create learning situations with connecting the learning content to real-world situations. Adaptive word in this learning model is used to describe the adaptability of learning model with contextual learning approach. For example, in the learning model doesn't use teaching and learning but it is only use learning terminology.

Integrated science is an approach which used in an integrated curriculum to describe the interrelationships between sub disciplines of science. Integrated science integrates the perspectives of sub disciplines such as biology, chemistry, physics, and earth/space science [12]. Through this integration, teachers expect students to understand the connections between the different sub disciplines and their relationship to the real world. Integrated science is defined as an approach to the learning of science in which concepts and principles are represented so as to express the fundamental unity of scientific thought and avoid premature or undue stress on the distinctions between the various scientific fields. An integrated science course eliminates the repetition of subject matter from the various sciences and does not recognize the traditional subject boundaries when presenting topics or theme [13]. In addition, integrated science provides the student with exposure and connections between the study of science and their real life.

Literacy is also important for students to get success in science learning and its application in daily life. Literacy is the ability to identify, understand, interpret, design, communicate, and learn to use printed and written materials relating to a variety of contexts [14]. Digital era is a term which used in the digital emergence, internet network, especially computer information technology. Digital age literacy is the ability in a particular field which required to find, to access, to use, and to evaluate the various information in digital technology and internet network. The digital age literacy skills consist of basic literacy, scientific literacy, economic literacy, technological literacy, visual literacy, information literacy and multicultural literacy [15].

The development of adaptive contextual learning model of integrated science needs to be done to solve this research problem. This learning model is important to be implemented to realize integrated science learning, to create the relevant context of science learning materials, and to develop literacy skills of students. For this reason, researcher is interested to conduct this research. The objective of this research is to understand the effectiveness of the implementation of adaptive contextual learning model of integrated science on knowledge, attitude and scientific processes skills competence.

2. Research methods

In general, type of this research is the research and development. This research is a research method to develop a particular product and to test its effectiveness. Product of this research and development is an adaptive contextual learning model. The research activity which reported in this article was a part of the research and development of adaptive contextual learning model of integrated science. A limited field testing was conducted to determine the effectiveness of the learning model that has been developed. Design research which used in limited field testing was before and after treatment for one group of sample. The effectiveness of learning model was determined by comparing the after and before treatment of student's competence. Thus, determining the effectiveness of the implementation of the learning model was important part of this limited field testing.

Subject of research was grade VIII students in SMP Negeri 8 Padang. Class sample of the research was one class of grade VIII students. The number of students which involved in research activity was 28 students. In research activities, adaptive contextual learning model was implemented to students for 6 meetings. Learning tools as a support system of the learning model were integrated science textbooks and integrated student worksheet. Integrated science textbook is accompanied by elements of contextual learning strategy while student worksheet is accompanied by digital age literacy. Therefore, motivation and involvement of students in the implementation of adaptive contextual learning model are essential to improve their competences.

Instrument to collect the data in this research can be grouped into three parts. First instrument was assessment sheet of student skill. This instrument was used to obtain data of scientific processes skill of students in learning model. The components of scientific processes skills include observing, asking question, formulating hypotheses, planning investigation, conducting investigation, interpreting data, summarizing investigation, and communicating the investigation result. The second instrument was observation sheet of student's attitudes in learning. Attitude aspects which observed were curiosity, self-confidence, discipline, inquiry commitment, cooperation, and communication. The third instrument was learning outcomes test sheet of knowledge competence of students. This instrument was used to obtain data of knowledge competence of students after and before implementing the adaptive contextual learning model. Therefore, these instruments were important to get the knowledge, attitude and literacy skills of students in limited field testing.

The research data were analyzed by using descriptive statistic analysis, normality test and homogeneity test, and paired comparison test. Descriptive statistics analysis was used to provide information about a data group of knowledge, attitude, and skill of student's competence. The parameters of the statistical analysis include minimum value, maximum value, range, mean value, median, mode, standard deviation and variance. The normality test was used to determine a group of data has normally distribution. Homogeneity test is used to determine the variance of two distributions have same values or different value. The paired comparison test was used to determine the difference of average value of student's competence after and before treatment. Hence, the existence of differences in student's competence between after and before of this treatment was important to indicate that the effectiveness of adaptive contextual learning model of integrated science on grade VIII students.

3. Results and discussions

In general, the result of this research consists of three parts, namely knowledge competence, attitude competence and skills competence. Knowledge competence is related to result of pretest and posttest of student's knowledge competence. Attitude is related to student attitudes which observed during the learning process of science. On the other hand, the competence of skills is related to scientific processes skills of students in conducting science investigation activity.

The first result of this research is the effectiveness of adaptive contextual teaching learning model of integrated science in knowledge competence. Pretest was given to students before implementing the

adaptive contextual learning model. The learning model was implemented for six meetings in three weeks on the use wave and optic materials in our lives. After implementing the learning model was given posttest to students. Number of students who follow the pretest and posttest activity was 28 students. The parameter values of the descriptive statistics, the normality test, the homogeneity test and paired comparison test can be seen in Table 1

Table 1. Value of Statistics Parameter of Knowledge Competence

No	Parameter of Statistics	Calculated Value	Reference Value
1	Mean of pretest	55.43	
2	Standard deviation of pretest	9.90	
3	Mean of posttest	71.29	
4	Standard deviation of posttest	10.17	
5	P-value of normality test of pretest	0.10	
6	P-value of normality test of posttest	0.15	0.05
7	P-value of F test	0.89	
8	Paired comparison test	-6.58	2.05

From the result of students pretest can be explained that the value of students varies between 28.00 to 68.00 with a range of 40.00. The average value on pretest is 55.43. This average value can be grouped into enough category. Standard deviation and variance of pretest result respectively 9.90 and 98.03. On the other hand the posttest value of students varies from 52.00 to 88.00 with range is 36.00. The average value of students on posttest activity is 71.29. The average value of students can be classified into good category. The standard deviation and variance value of the posttest respectively 10.17 and 103.47.

The P value for 28 students on pretest is 0.10, while the P value for posttest is 0.15. A significant level is established on $\alpha = 0.05$. This means that groups of data both pretest and posttest have normally distribution. F test is also done to group data of pretest and posttest to determine the homogeneity of these data. From the homogeneity test obtained the value of F is 0.89. This F value is greater than the value of $\alpha = 0.05$. This means that data groups both posttest and pretest have same variance. Therefore, data groups both pretest and posttest come from the same variance.

The effectiveness of implementation of adaptive contextual learning model of integrated science is determined by comparing posttest result and pretest result of knowledge competence. Paired comparison test is used to analyze this difference. The paired sample t test compares two mean values from the same individual of students. The two mean values present two differences of time such as pretest and posttest with a treatment between two times. The purpose of this test is to determine the difference between the results paired test which observed on a particular competency outcome. This paired t test can be entered into the parametric test.

Paired comparison test is used to analyze the difference knowledge competence of 28 students, value of mean and standard deviation of pretest respectively 5.43 and 9.90, value of mean and standard deviation of the posttest respectively 71.29 and 10.17. The value of paired t test is $t = -6.58$ and P value is 0.00. Meanwhile, the value of t in table for the number of 28 students, degree of freedom is 27 and the significant level $\alpha = 0.05$ and a half of $\alpha = 0.025$ is 2.05. The value of calculated t is outside the acceptance area of the null hypothesis. From this result can be stated that there are significant difference in students learning outcomes between after and before implementing of adaptive contextual learning model of integrated science. The existence of this difference indicates that the implementation of adaptive contextual learning model gives a significant effect on the knowledge competence of students. Therefore the implementation of adaptive contextual learning model of integrated science by integrating digital age literacy is effective to improve knowledge competence of students.

The second result of this research is the effectiveness of implementation of adaptive contextual learning model of integrated science on attitude competence of students. Before implementing the adaptive contextual learning model was observed student attitudes. Attitudes of students were

observed for two meetings. After implementing the adaptive contextual learning model also observed attitude of students for six meetings. Attitude of students which observed in learning consists of six component, those are: 1). curiosity, 2). self confident, 3). discipline, 4). commitment inquiry, 5). cooperation, and 5). communication. The values of descriptive statistics parameters, P-value of normality test, P-value of homogeneity test and t-value of paired comparison test for attitude competencies of students can be shown in Table 2

Table 2. Parameters Value of Attitude Competence

No	Parameter of Statistics	Calculated Value	Reference Value
1	Mean before treatment	57.74	
2	Standard deviation before treatment	11.82	
3	Mean after treatment	77.18	
4	Standard deviation after treatment	8.51	
5	P-value of normality test before treatment	0.06	
6	P-value of normality test after treatment	0.15	0.05
7	P-value of F test	0.09	
8	Paired comparison test	-13.3	2.05

The mean values of student's attitudes and standard deviations on the initial condition were 57.74 and 11.82 respectively. Meanwhile, the mean value of student's attitudes competence and standard deviation after implementing the adaptive contextual learning model respectively 77.18 and 8.51. From normality test is obtained P value for attitude competence data before implementing adaptive contextual learning model is 0.06, while P value for attitude competence after implementing this learning model is greater than 0.15. Both p value before and after implementing the learning model is larger than α value is 0.05. From this result can be explained that the data group of attitude competence of students before and after implementing the adaptive contextual learning model are distributed normally. On the F test, the P value of two data groups of attitude competence of students was obtained 0.09. This F value is larger than α value so it can be stated that variance of the two data groups of student's attitude competency has same variance. Thus, the two data groups of student's attitude come from homogeneous variance.

For the number of students is 28 students, the mean and standard deviation of data group of attitude competence before implementing this learning model respectively 57.74 and 11.82, the mean and standard deviation after implementing this learning model were 77.18 and 8.52, respectively, the paired t test is - 13.33. The P value for this descriptive statistic parameter is 0.00. By using two-tails test for freedom degree of 27 students, significant level $\alpha = 0.05$, a half of $\alpha = 0.025$, the t value in table is $t_{0.975} = 2.05$. It means that the value of calculated t is outside the acceptance area of null hypothesis. With another expression, P value less than α value. From this paired comparison test, it can be stated that there is a significant difference in student's attitude competence between after implementing the adaptive contextual learning model and before implementing this learning model at 95% confidence level. Therefore, the existence of significant difference in attitudes competency of students indicates that the implementation of adaptive contextual learning model of integrated science is effective to improve attitudes competence of grade VIII students in junior high school.

The last result of this research is effectiveness of adaptive contextual teaching learning model of integrated science in skill competence on scientific process activities. Both before and after implementing the adaptive contextual learning model, skills of students were assessed by using performance assessment. Scientific processes skills of students which assessed in learning consist of eight components, namely 1). observing, 2). asking question, 3). formulating hypothesis, 4). planning investigation, 5). conducting investigation, 6). interpreting data, 7). getting conclusion, and 8). communicating. Performance of students was assessed before and after implementing the adaptive contextual learning model. These student performance data were analyzed with appropriate statistics. The values of descriptive statistics parameters, p-value of normality test, p-value of homogeneity test and t-value of paired comparison test of processes scientific skills are displayed in Table 3

Table 3. Parameters Value of Scientific Processes Skills

No	Parameters of Statistics	Calculated Value	Reference Value
1	Mean before treatment	56.25	
2	Standard deviation before treatment	6.96	
3	Mean after treatment	71.99	
4	Standard deviation after treatment	7.96	
5	P-value of normality test before treatment	0.03	0.05
6	P-value of normality test after treatment	> 0.15	
7	P-value of F test	0.49	
8	Wilcoxon paired comparison test	-4.63	1.90

Before implementing the adaptive contextual learning model, the average value of scientific processes skills of students and standard deviation are 56.25 and 6.96, respectively. On the other hand, after implementing this learning model, the average value and standard deviations of scientific processes skills of students are respectively 71.99 and 7.96. In normality test, the P value of skill competence for data group before implementing adaptive contextual learning model is 0.03, while P value of skill competence for data group after implementing this learning model is greater than 0.15. This means that the data group of scientific processes of students before implementing the learning model has normally distribution while the data group of scientific processes skills of students after implementing the learning model is also has normally distribution. On the other side, the P value on F test of the two groups of scientific processes skills of students is 0.49. This P value is greater than α value = 0.05. From result of this F test can be argued that the variance of both after group data and before group data of scientific processes skills is same. Thus, both initial data group and final data group of scientific processes skills of students have same variance.

The result of normality test indicates that the data group of scientific processes skills of students before implementing learning model hasn't normally distribution, the data group after implementing the learning model has normally distribution, and the variance of two data groups of scientific processes skills of students have same variance. For this reason, the difference test which used in data analysis is the Wilcoxon paired comparison test. The Wilcoxon test is a nonparametric test which used to analyze pairs of observations of data group with non-distributed normally. By using Wilcoxon paired comparison test it can be obtained of Z value = - 4.63 and Sig 0.00. At the significant level $\alpha = 0.05$ with two-tailed test the value of a half of the significant level of 0.025, the area of the curve F (z) of 0.475, the value of Z in table is 1.95. This is mean that the value of calculated Z is outside acceptance area of null hypothesis. In other way the Sig value which obtained is smaller than the α value so that the null hypothesis is rejected. From Wilcoxon paired comparison test, it can be stated that there is a significant difference in scientific processes skills of students between after implementing the adaptive contextual learning model with before implementing the learning model at 95% confidence level. Therefore, this significant difference in scientific processes skills of students indicates that the implementation of adaptive contextual learning model of integrated science is effective to improve the scientific processes skills of grade VIII students in junior high school.

4. Conclusion

From the analysis of data which has been done it can be stated the conclusion of this research. The conclusion of this research is the implementation of adaptive contextual learning model of integrated science gives significance difference on competences of students including knowledge, attitude, and scientific processes skills of competences at 95 % confidence level. Therefore, the implementation of adaptive contextual learning model of integrated science is effective to improve knowledge, attitude and scientific processes skills competences of grade VIII students in junior high school.

References

- [1] Germaine, Ron, et al. 2016. Purposeful Use of 21st Century Skills in Higher Education. *Journal of Research in Innovative Teaching*. Volume 9, Issue 1
- [2] Adedokun and Olufunke, Mary. 2014. Literacy in Early Childhood: Implications for Sustainable Development. *Proceeding of 1st Annual International Interdisciplinary Conference, AIIC*, 24-26 April, Azores, Portugal
- [3] Wahyuni, Dewi Sri. 2017. Promoting Literacy Skills Through Journal Writing. *The 1st International Conference on Language, Literature and Teaching*
- [4] Drake, Susan M and Savage, Michael J. 2016. Negotiating Accountability and Integrated Curriculum from a Global Perspective. *International Journal of Learning, Teaching and Educational Research*, Vol. 15, No. 6, pp. 127-144
- [5] Wiyanto and Widiatmoko, Arif. 2016. Preparation Model of Student Teacher Candidate in Developing Integrative Science Learning. *Journal of Education and Human Development*, Vol. 5, No. 2, pp. 169-177
- [6] Asrizal, et al. 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.
- [7] Asrizal, et al. 2017. Development of Integrated Science Teaching Material of Our Digital System Health by Integrating Scientific Literacy for Grade Students. *Proceeding International Conference on Global Education Education V*. Volume 1A, p 491-504.
- [8] Metzler, Michael W. 2017. *Instructional Model For Physical Education*. Third Edition, Routledge Taylor & Francis Group, London and New York.
- [9] Subramani, P. C. Naga. 2016. *Effective Teaching and Learning*. First Edition, Laxmi Book Publication, Solapur, Ashok Yakkaldevi
- [10] Sears, Susan Jones. 2002. *Contextual Teaching and Learning: A Primer for Effective Instruction*. Phi Delta Kappa Education Foundation
- [11] Sung, Han-Yu, et al. 2015. An Integrated Contextual and Web-based Issue Quest Approach to Improving Students' Learning Achievements, Attitudes and Critical Thinking. *Journal of Educational Technology & Society*, 18 (4), 299-311
- [12] Mubita, Simamuna Likando and Kalimaposo, Kalisto. 2016. Factors Affecting Teaching and Learning of Home Economics in the Integrated Primary Curriculum: A Study of Selected Primary Schools in Lusaka province of Zambia. *International Journal of Multidisciplinary Research and Development*, Volume 3; Issue 11; Page No. 09-16
- [13] Opara, Jacinta A. 2011. Bajah's Model and the Teaching and Learning of Integrated Science in Nigerian High School System. *International Journal of Academic Research in Business and Social Sciences*, Vol. 1, Special Issue
- [14] Chew, Fong Peng. 2012. Literacy among the Secondary Schools Students in Malaysia. *International Journal of Social Science and Humanity*, Vol. 2, No. 6
- [15] Turiman, Punia, et al. 2012. Fostering the 21st Century Skills through Scientific Literacy and Science Process Skills. *Elsevier, Procedia - Social and Behavioral Sciences* 59, 110 – 116