Effects of science student worksheet of motion in daily life theme in adaptive contextual teaching model on academic achievement of students

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Abstract. Ministry of Education and Culture of Indonesian has demanded that the integration of the disciplines of science and literacy skills in teaching. However, the real condition shows that the application of integrated science teaching and integration of literacy skills was still become problem in science teaching. A solution to solve this problem is to develop a thematic science student worksheet by integrating literacy to be applied in the adaptive contextual teaching model. The objective of the research is to determine the effect of the science student worksheet of motion in daily life theme on the academic achievement of students. This research was part of the research and development that has been done. The research data were taken on main field testing on a wider scale. The research instrument consists of three parts, namely written knowledge test, attitudes observation sheet, and performance assessment sheet of students. The achievement data of students were analyzed by descriptive statistics, normality test, homogeneity test and comparison test. The result of data analysis stated that the use of the science student worksheet in the adaptive contextual teaching model of motion in daily life theme gives significant effect on knowledge, attitudes and literacy skills of grade VIII students.

1. Introduction
Skills are required by students in the 21st century in achieving success in teaching and learning, everyday life and their future. These skills are known as 21st century skills that is a set of abilities of students needed to develop themselves in efforts to achieve success in the information age [1]. To ensure this success, students not only need to understand the deep of science subject, but also be able to apply this knowledge to important themes in life by using the skills variation. For this reason, the education needs to produce not only the relevant knowledge, but also the skills of interpersonal relationships, communication, working in various contexts and literacy skills [2].

The use of theme in teaching will foster the development of student literacy, which relevant to 21st century education. On this reason, the Indonesian Ministry of Education and Culture demands that both natural science and social science subjects to be developed in integrated form. The teaching content of natural science in junior high school is based on integrated concepts from various disciplines of natural science. The content of natural science comes from the disciplines of biology, physics and chemistry. The objective of science education emphasizes the understanding of the environment and the natural surroundings and its riches that need to be conserved and preserved in the perspective of biology, physics, and chemistry. Therefore, the implementation of integrated teaching of science is important in junior high school
The Indonesian Ministry of Education and Culture also encourages the improvement literacy of the academic community through school literacy movement program. There are at least two reasons for the importance of this school literacy movement. The first reason, the school is an intellectual community that involves various elements such as students, teachers and parents. A national movement can be achieved with good result if it carried out together. The second reason, the school can be interpreted as a process to make changes through learning. In this case, literacy is an activity which required by each student to support the process of change. Improvement of student literacy in education is important to be done so that they become lifelong learning.

However, the real condition shows that the application of integrated teaching of science and the integration of literacy in teaching can’t be implemented well. There are at least three conditions for the application of integrated teaching of science in schools that have been identified. First, the science teaching which conducted in schools were still taught separately into sub-disciplines of biology, physics and chemistry [3,4,5]. Second, the science teaching materials in integrated science textbooks were still written separately into sub-disciplines of biology, physics and chemistry [6,7,8]. Third, most science teachers still have difficulty in applying integrated science teaching in school [9,10,11].

In the integration of literacy in the teaching process also found limitations and obstacles. Literacy which applied in schools is still limited to reading skill within 15 minutes before teaching process. Whereas many variations of literacy skills are required by students to achieve success both in the learning process and in their daily life in the 21st century. In addition, study results from PISA indicated that the literacy skills of Indonesian students were still in the low category [5,12,13]. Complete data which state that the scientific literacy of Indonesian students were low it can be known from reports from PISA in 2010 and 2012 [14,15].

The existence of a gap between ideal condition and real condition indicates a problem in this research. An alternative solution to solve this problem is to apply student worksheet of integrated science teaching by integrating literacy in the adaptive contextual teaching model (ACTM). Giving task in student worksheet can encourage the active participation of students and train literacy skills of students in the teaching process.

A student worksheet is sheets containing tasks which must be done by students [16,17,18]. Another meaning of student worksheet is a part of the instructional materials that can be used to develop thinking skills, ask questions and answer questions, make relationships and assess student learning outcomes [19]. The use of tasks in the student worksheet will encourage activity and participation of students in learning. Students will be involved in constructing knowledge and improving learning skills. Thus, the use of student worksheet in teaching will encourage the improvement of knowledge and the skills aspect of students.

A student worksheet can support students to understand teaching materials and provide good opportunities for demonstrating their knowledge and developing process skills [19]. Student worksheet can also improve student learning success, make students more active and efficient in learning and develop creative thinking skills [20]. In addition, the use of student worksheet in teaching can improve the experience of students [19]. The advantages of using the student worksheets in the teaching process, as follows: 1). to provide real experience for students, 2). to help students learn in various variations, 3). to increase student interest and motivation, 4). to increase student attention in the learning process, and 5). to use time more effectively and efficiently [21]. Therefore, the use of student worksheets in the teaching process will have a good effect on the knowledge and the skills aspect of students in teaching.

The use of the science student worksheet in ACTM provides several advantages. First, contextual teaching will encourage students to connect teaching materials to relevant real-world contexts so that teaching is meaningful. Second, contextual teaching is accordance with the performance of the brain so that knowledge can be stored for a long time [22]. Third, contextual teaching is accordance with the characteristics of integrated teaching, i.e. authentic, meaningful, active and holistic. Finally, the integration of literacy skills in the student worksheet will train students to develop the various literacy skills which required in their learning and daily life.
The effect of the use student worksheet which expected in ACTM is the academic achievement of the students. Academic achievement or academic performance is the result of education which required by students and teachers to achieve educational goals [23]. Academic achievement is a measure of student success for either the purpose of short meeting or long time meeting in education [24]. The academic achievement of the students refers to the performance of the students in a given academic area [24] and it indicates learning outcomes for students [25]. Thus, academic achievement has a broader meaning includes the ability of knowledge, degree of competence, skills which developed, student behaviour and so on.

The use of student worksheet of integrated science teaching in motion in daily life in ACTM is an alternative solution to solve this problem. For this reason, research to use science student worksheets in motion theme in daily life can be considered in this research. Therefore, the objective of this research was to investigate the effect of using the student worksheet of integrated science teaching in ACTM on the academic achievement of grade VIII students.

2. Research method
The research which reported in this article is part of the development research. The effect of the use student worksheet of the integrated science teaching in ACTM was observed in the main field testing of the product. The research design which used in the use filed testing was non-equivalent group design with two sample groups. In the experimental group also used the design before and after the use of student worksheet of the integrated science teaching.

The population of research on the main field testing was all the students of grade VIII in SMP Negeri 13 Padang. The number of classes in grade VIII in this school was 8 classes. Each class consists of 32 students. Thus, the total number of students in grade VIII was 256 students.

The sampling technique used a combination of purposive sampling and cluster random sampling. Purposive sampling was used to determine which classes which have the same initial ability. On the other hand, cluster random sampling was used to determine the experimental group and control group. Using both purposive sampling and cluster random sampling techniques was obtained class VIII A as experimental group and class VIII B as control group.

In the main field testing of the product was used four instruments to obtain research data, namely the document of knowledge test result, written knowledge test, attitudes observation sheet, and performance assessment sheet. The document of knowledge test result was obtained from administration staff of SMPN 13 Padang. The written knowledge test was used to get knowledge ability of students after using the student worksheet of the integrated science teaching in ACTM. Attitude observation sheet was used to obtain student attitudes during the use of student worksheet in ACTM. Meanwhile, performance assessment sheet was used to obtain literacy skills of students before and after using student worksheet of the integrated science teaching including functional literacy, scientific literacy and visual literacy.

Research data which obtained in the main field testing of the product were analyzed by descriptive statistics analysis, normality test, homogeneity test, comparative test of two sample groups and paired comparison test. Descriptive statistics analysis was used to describe data of pretest and post-test, student attitudes and student literacy skills. Normality test was used to determine the normal distribution of a data group. Homogeneity test was used to determine the similarity of variance of the two data groups. The result of normality test and homogeneity test were used as consideration in choosing comparison test. The comparison test of two sample groups was used to determine the difference in knowledge and attitudes aspect of students between the experimental group and the control group. On the other hand, the paired comparison test was used to determine the difference in the literacy skills of students after and before using student worksheet of integrated science teaching of experimental group.
3. Result and discussion

The first result of the research on main field testing was related to the effect of the use student worksheet of integrated science teaching in ACTM on knowledge ability of students. After using student worksheet, students on experimental group and control group were given posttest. The learning material of post-test related to the motion in daily life theme. Post-test data on both experimental group and control group were analyzed by using descriptive statistics, normality test and homogeneity test and comparison test of two sample groups. The results of the analysis of the data in the experimental group and control group can be seen in Table 1.

| No | Statistics analysis | Parameters of statistics | Experiment group | Control group |
|----|---------------------|--------------------------|------------------|---------------|
| 1  | Descriptive statistics | Mean                      | 66.02            | 52.66         |
|    |                     | Mode                      | 75.00            | 47.50         |
|    |                     | Median                    | 65.00            | 53.75         |
|    |                     | Standard deviation        | 10.87            | 9.09          |
|    |                     | Variance                  | 118.09           | 82.64         |
|    |                     | Minimum                   | 47.50            | 27.50         |
|    |                     | Maximum                   | 87.50            | 70.00         |
| 2  | Normality test      | AD                        | 0.283            | 0.294         |
|    |                     | P-value                   | 0.612            | 0.578         |
| 3  | Homogeneity test    | Test statistic            | 1.430            |               |
|    |                     | P-value                   | 0.325            |               |
| 4  | Comparison test     | T-value                   | 5.330            |               |
|    |                     | P-value                   | 0.000            |               |

The knowledge value of the students in the experimental group varies from 47.50 to 87.50 with a range of 40.00. The average value of knowledge aspect of students in the experimental group is 66.02 and this average value can be classified into the good category. On the other hand, the knowledge value of the students in the control group varies from 27.50 to 70.00 with a range of 42.50. The average value of knowledge aspect of students in the control group is 52.75 and this average value can be included into enough category. It means the average value of knowledge aspect of students in the experimental group is higher than the average value of the knowledge aspect of the control group.

The characteristics of the knowledge data of the experimental group and the control group were determined from the normality test and the homogeneity test by using Minitab software 1.6. In the normality test for the knowledge data from the experimental group was obtained P-value = 0.612 while for the control group data were obtained the P value = 0.578. Both P values of the experimental group data and the control group data are greater than the value of significant level α = 0.05. This means that both groups of knowledge data of students in the experimental group and control group have a normal distribution. On the other hand, in the homogeneity test of both knowledge data from the experimental group and control group was obtained P value = 0.325. This P-value is greater than the significant value α = 0.05. The result of this test indicates that both of knowledge data of students in the experimental group and control group have the same variance.

The comparison test to analyze the data was determined based on the normality test and the homogeneity test of the knowledge data of students. From the results of the normality and homogeneity test can be stated that the knowledge data of students from the experimental group and control group have normal distribution and same variance so that it can be used parametric statistics. From the comparison test the two sample groups was obtained t value = 5.33. At the 95% confidence level and degrees of freedom 62 was obtained t table = 2.00. In the two-tailed tests, the result of this comparison test shows that the value of calculated t is outside the acceptance area of the null hypothesis. This means that there is a significant difference the average value of knowledge competence between students which use the student worksheet of integrated science teaching and
students which didn't it in ACTM implementation. The initial condition the average value of the knowledge competence from both experimental group and control group were the same value. Thus, the use of student worksheet of integrated science teaching by integrating literacy skills in ACTM has a significant effect on knowledge competence of grade VIII students at 95% confidence level.

The second result of research on the main field testing relates to attitudes aspect of students. In the experimental group, attitudes of students were assessed in ACTM by using the student worksheet of integrated science teaching. There were six attitudes indicators of students, which assessed by using attitude observation sheet, namely: curiosity, self-confidence, inquiry commitment, discipline, cooperation, and communication. The data attitudes of students from the experimental group and the control group were analyzed with appropriate statistics. The results of descriptive statistical analysis, normality test and homogeneity test, and comparison test of two sample groups of attitudes value of students are shown in Figure 2

| No | Statistics analysis | Statistics parameters | Experimental group | Control group |
|----|---------------------|-----------------------|-------------------|--------------|
| 1  | Descriptive statistics | Mean                   | 80.78             | 77.17        |
|    |                     | Mode                   | 79.18             | 80.23        |
|    |                     | Median                 | 80.75             | 77.11        |
|    |                     | Standard deviation     | 3.31              | 2.80         |
|    |                     | Variance               | 10.93             | 7.84         |
|    |                     | Minimum                | 73.99             | 72.95        |
|    |                     | Maximum                | 86.49             | 83.37        |
| 2  | Normality test      | AD                     | 0.244             | 0.594        |
|    |                     | P-value                | 0.744             | 0.114        |
| 3  | Homogeneity test    | Test statistic         | 1.39              |              |
|    |                     | P-value                | 0.359             |              |
| 4  | Comparison test     | T-value                | 4.71              |              |
|    |                     | P-value                | 0.00              |              |

In Figure 2, the average value of student attitudes in the experimental group is 80.78 while in the control group is 77.17. This means that the average value of students' attitudes of the experimental group is higher than the average value of the control group. The P values of the normality test result in both experimental and control groups were 0.744 and 0.114, respectively. The P values of experimental group and control group are greater than the significant value of $\alpha = 0.05$. From the normality test, it is known that both data of students' attitude in experimental group and control group have a normal distribution. The P value of the homogeneity test result was obtained 0.359. This means the P value greater than the significant value. The result of the homogeneity test indicates that the data of students' attitude have the same variance.

The results of normality test and homogeneity test were used to choose the statistics test. For this reason, comparison test is used to determine the difference in the average value of student attitudes of the experimental group and the control group. From comparison test obtained $t$ value = 4.71. The value of calculating $t$ is outside the area of acceptance of the null hypothesis. The result of this hypothesis test indicates that there is a significant difference of the average value of student attitudes between students who use the student worksheet of integrated science teaching in ACTM and students who don’t use it. Thus, the use of student worksheet of integrated science teaching in ACTM has a significant effect on the attitudes aspect of students.

The final result of the research on main field testing was related to the digital age literacy of the students. Student performance value which related to literacy skills was taken before and after using student worksheet of the integrated science teaching. There were three components of digital age literacy that were assessed in ACTM process, namely: functional literacy, scientific literacy and visual
The data of literacy skills were analyzed by descriptive statistics. The average value of literacy skills of students in the experimental group before and after using the student worksheet in ACTM is shown in Figure 1.

![Figure 1. Average value of literacy skills of students](image)

The average value of functional literacy, scientific literacy and visual literacy in Figure 1 before using the student worksheet of integrated science teaching were 40.63, 55.75 and 40.05, respectively. These average values can be grouped into low and medium categories. After they use student worksheet of integrated science teaching, the average value of the three literacy skills were 71.31, 72.38 and 57.03 respectively. These average values can be entered into good and medium category. Thus, the average values of literacy skills of students after using student worksheet of integrated science teaching are higher than the average values before they use it.

Data of functional literacy, scientific literacy and visual literacy of students before and after using student worksheet of integrated science teaching were analyzed with appropriate statistics. The results of descriptive statistical analysis, normality test and comparison test paired in the experimental group for the three literacy components can be considered in Table 3.

**Table 3. Result data of statistics analysis of literacy skills of students**

| No | Parameter Statistic | Functional Literacy | Scientific Literacy | Visual Literacy |
|----|---------------------|---------------------|---------------------|-----------------|
|    |                     | Before | After | Before | After | Before | After |
| 1  | Descriptive statistics | Means  | 40.63 | 71.31 | 55.75 | 72.38 | 48.05 | 57.04 |
|    |                     | Standard deviation | 7.27 | 6.89 | 5.98 | 6.73 | 15.91 | 9.33 |
|    |                     | Variance  | 52.82 | 47.58 | 35.74 | 45.34 | 253.12 | 87.03 |
| 2  | Normality test | AD  | 0.809 | 0.757 | 0.336 | 0.507 | 0.840 | 0.534 |
|    |                     | P-value | 0.032 | 0.044 | 0.486 | 0.187 | 0.027 | 0.159 |
| 3  | Homogeneity test | T-value  | 1.11 | 0.79 | 0.004 |
|    |                     | P-value | 0.773 | 0.558 | 0.021 |
| 4  | Paired comparison test | T-value | -14.22 |
|    |                     | P-value | 0.00 |
| 5  | Wilcoxon test | Z | -6.96 | -3.41 |
In Table 3, the average values of students for the three literacy components after using the student worksheet of integrated science teaching were higher than the average values before using it. In the normality test, it is obtained the value of data of scientific functional of students before and after using the student worksheet of integrated science teaching don’t have a normal distribution. Data of scientific literacy of students before and after using student worksheet have a normal distribution. Meanwhile, the data of visual literacy of students before using student worksheet have a normal distribution whereas after using the student worksheet doesn’t have normal distribution. On the other hand, in homogeneity test, data of functional literacy and scientific literacy before and after using student worksheet each has the same variance while data of visual literacy of students don’t have the same variance.

The comparison test for one sample group was determined based on the normality test and the homogeneity test of literacy skills data of students. In the data of functional literacy and visual literacy, the Wilcoxon test was used, whereas in data of scientific literacy was used the paired comparison test. From the Wilcoxon test for nonparametric statistics were obtained Z values for functional literacy and visual literacy respectively -6.96 and -3.41. Both values of calculating Z were outside of the acceptance area of the null hypothesis. On the other side, from the result of the paired comparison test for parametric statistics of scientific literacy was obtained the calculated value of $t = -14.22$. The value of calculating was outside of the acceptance area of the null hypothesis. From this hypothesis test can be stated that there is a significant difference of three literacy skills of students before and after using the student worksheet of integrated science teaching. Therefore, the use of student worksheet of integrated science teaching in ACTM has given significant effect on improvement of literacy skills of students, including functional literacy, scientific literacy and visual literacy at 95% confidence level.

4. Conclusion

From the data analysis can be stated the conclusion of the research on the main field testing of this product. Conclusion from this research is the use of student worksheet of integrated science teaching by integrating literacy in ACTM has given significant effect on the improvement of knowledge aspect, attitude aspect and literacy skills aspect of grade VIII students. Literacy skills of students in this case, including functional literacy, scientific literacy and visual literacy. Therefore, science teachers and students can use this science student worksheet as an alternative to support the learning process of grade VIII students.

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