Using science digital storytelling to increase students' cognitive ability

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Using science digital storytelling to increase students' cognitive ability

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Abstract. The purpose of this research is to understand whether or not science digital storytelling can improve cognitive ability. The research design used in this study was one shoot case study. The population of the research was seventh-grade students of junior high school. The number of samples involved in this study was two classes with a total of 68 students. Data of students' cognitive ability were collected using a test. The data that has been collected were then analyzed using N-gain test. Results of data analysis showed that N-gain values of experimental groups are equal to 0.48 and 0.42 which are categorized into medium category. This finding indicates that science digital storytelling can improve students' cognitive ability.

1. Introduction

In the academic year 2013/2014, the curriculum that began to be implemented in some schools for class I, IV, VII, and X is the 2013 curriculum as a reform of the Education Unit Level Curriculum (KTSP) [21]. Science lessons in the 2013 curriculum must be taught in an integrated manner, not separated into Physics, Chemistry, and Biology, thus, science learning is known as integrated science learning. Rahayu and Laksono [20] added that in the application of integrated science learning, a fundamental change in the process of delivering the material is required so that learning can give a positive impression to students. Teachers are required to creatively create learning that is conducive, interesting, and enjoyable. The 2013 curriculum does not only emphasize students who are required to be more active in finding information, but teachers are also required to be more creative and innovative in delivering the material. The material presented by teachers should be interesting and can provoke students' activeness. In some schools in Semarang, teachers still deliver learning material by conventional methods and media, such as teacher-centered method [6].

Teacher-centered learning takes place in unidirectional, monotonous, less vary and students become passive because they only become listeners. The teaching method has resulted in the number of students less familiar with the learning material because the lecture method is not able to help students to store the information in long-term memory so that students easily forget the topic being taught. The main reason of the use of the lecture method is that the learning material contains a lot of memorization, so the teacher faced difficulties to design the appropriate teaching method.

The results of several early observations of junior high schools in Semarang showed the use of media in less integrated science learning [6]. The media that teachers often used is conventional media, such as books, whiteboard, Power-Point presentations that has resulted in the low of students' learning outcomes. Purnamasari et al. [17] explained that the lack of media utilization was one of the reasons that learning outcomes of students in SMP Negeri 16 Pekalongan was less than the maximum. Istiani

and Retnoningsih [8] added that the impact of minimum utilization of media in learning was not optimal results of students' learning in SMP Negeri 1 Petanahan.

Maharani and Dewi [14] stated that the use of media could improve student learning outcomes. This is in line with Pramana and Dewi [16] research which has developed integrated science e-book, Dewi and Akhlis [5] who developed teaching materials using traditional games, Taufiq et al. [30] who developed electronic portfolio media, and Akhlis and Dewi [5] who have developed learning media based on Information and Communication Technologies (ICT) [2] mentioned that multimedia is a combination of several kinds of information that can be in the form of graphics, text, images, sound, animation, and video. The multimedia program is appeal for the users because of its interactive features [28]. Daryanto [4] explained the benefits of multimedia learning, such as making learning process more interactive and interesting, improving the quality of students' learning, and teaching and learning process can be done flexibly (anywhere and anytime). Interactive multimedia can also reduce students' misconception because of its contextual characteristics so that the topic is easily understood [26].

Based on the questionnaire distributed to students of SMP Negeri 22 Semarang, students had difficulties in the classification of objects and living things because the learning material requires memorizations and contain many scientific names so less familiar to the students. The material also contains many chemical formulas, so it looks abstract for students. The difficulty of the students can be seen from the learning outcome. The research conducted by Purnamasari [17] showed that in the classification of objects and living things, Junior High School 16 Pekalongan students had not been able to reach the Minimum Completeness Criteria (KKM) of 65. The Junior High School 1 Wonosobo students also have difficulties in classification material, from 28 students there was only one student who could complete the KKM, and the average score was 55.03 while the KKM is set at 75 [22]. The classical completeness criterion of SMP Negeri 1 Petahanan shows 60% [8]. It further proves that classification material in class VII is difficult to understand.

Digital media storytelling is a film-based learning media which contains learning materials. Based on the research that has been done, the use of digital media storytelling can improve student achievement. Digital storytelling science as a multimedia learning that is used properly and well will provide benefits in the learning process. Digital storytelling science plays a role in incorporating some of skills including speaking, writing, listening, and operating ICT-based programs. Some of the benefits of digital storytelling include cultivating creativity, creating a positive classroom atmosphere, and focusing students' attention.

Maddin [13] stated that digital storytelling is the art of storytelling by combining various digital multimedia, such as text, images, narrative recordings, audio, video, and music that results in an interesting short film to present information of a particular topic. The information or stories presented can be historical events, personal lives, or other stories which have a short duration of time. The use of digital science storytelling as a medium of learning is very limited. In Indonesia, digital storytelling has never been used, especially in science lessons although according to Robin [21] digital storytelling is a superior media that can grow the skills of the 21st century. Students must be equipped with 21st-century skills to compete well in the global world. Rotherham and Willingham [23] revealed that the success of students depends on 21st-century skills they have. The use of digital media storytelling can also increase student learning activities, such as asking, encourage students to express their ideas, and respond questions asked by teachers or friends in the classroom [31]. The reason for using this media is because this media is contextual. Contextual-based media makes students easier to understand learning material. Thus, students will be aware of what they have learn and the benefits that they can derive from the material. This study aims to determine the improvement of students' cognitive learning outcomes through learning using digital storytelling science.

2. Research method

This research used one shoot case study design. The population used was the seventh-grade students of junior high school. The sample was selected using simple random sampling technique. Homogeneity test results showed that the population is homogeneous. The number of samples used was two classes

with a total of 68 students. Data collection techniques used in this study was a test to obtain data about students' cognitive ability.

The improvement of students' cognitive ability in experimental classes was caused by the application of digital storytelling science. In this study, digital storytelling science means a learning media in the form of educational films depicting the daily life of students. The film contains several learning topics with duration 10-15 minutes. The film was developed based on seven components of digital storytelling, namely point of view, dramatic question, emotional content, voice, soundtrack, economy, and pacing [21] so that the media can be used as an interesting learning resource to improve students' cognitive abilities.

Point of view on digital science storytelling contains initial information about story content. This initial information is the title of the story and the subject matter of the classification of plants and living creatures. Through this component from the beginning of learning the students have been given what information will be obtained through digital media storytelling, so the students' attention has been focused on the objectives to be achieved material.

The dramatic question contains the question. This component provokes students' curiosity and directs students in obtaining information, so students become more challenged in learning. The Emotional content component contains a simple and varied story or information presentation, so students do not get bored. A voice contains the voice entered in conveying information, the voice must be clear and by the contents of the story delivered. The soundtrack contains music that is included in the media that serves to support the delivery of information to become more interesting. Economy contains the right time management so that the delivery of information according to goals and on target. Pacing contains the time lag given in the information delivery process. The data has been collected and then analyzed by increasing test using N-gain test.

The normalized gain formula is as follows:

$$N-g = \frac{(p_{\text{-}} - t_e\, s_\cdot) - (p_\cdot - t_e\, s_\cdot)}{(m_\cdot\, s_\cdot) - (p_\cdot - t_e\, s_\cdot)}$$

These results are classified into the criteria based on Table 1.

Table 1. Score criteria for critical thinking skill.

g Score	Criteria
$g < 0.3$	Low
$0.3 \leq g < 0.7$	Medium
$g \geq 0.7$	High

Improved critical thinking skills are said to be good if the percentage is obtained $\geq 0.3\%$. If the percentage is $<0.3\%$, then it belongs to the low category.

3. Result and discussion

Analysis of cognitive learning outcomes relied on pretest and posttest data of experimental students in the two classes. The analysis used in the test result data was N-gain. The N-gain test was used to measure the increase of pretest and posttest values in the two experimental classes. The average increase of students' cognitive learning outcomes are presented in Table 2.

Table 2. The n-gain results of students' cognitive learning.

Class	N	Average of Pre-Test	Average of Post-Test	N-gain	N-gain Criteria
Experimental One	32	30.22	63.67	0.48	Medium
Experimental Two	36	44.07	67.76	0.42	Medium

Table 2 shows that students' cognitive ability of both experimental classes increase with moderate criteria. Both classes were given a learning applying digital storytelling science. In addition to calculating the improvement of cognitive ability, students' cognitive ability was also analyzed using the reference value of classical clarity of at least 70. The result of classical completeness analysis of the cognitive ability of students can be seen in Figure 1.
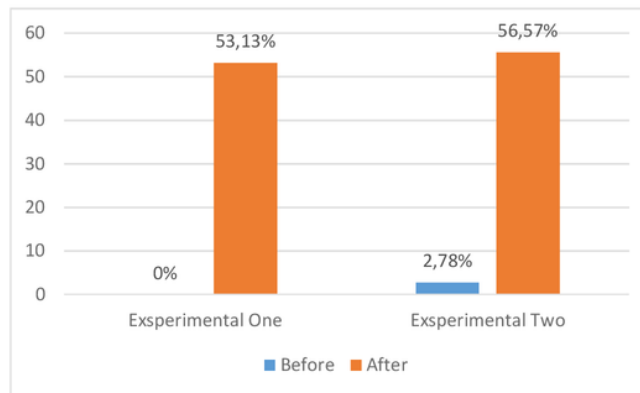

Figure 1. The completeness of classical cognitive ability of students in each class.

Figure 1 shows that the classical completeness of students' cognitive ability in both experimental classes experienced a significant improvement. This results is because both experimental classes applied learning by using contextual-based digital storytelling science.

The research that has been done by Suwardy et al. [29] stated that digital storytelling can enhance students 'activity, improve students' ability to relate theories to the case, and make learning interesting and effective. Another study related to digital storytelling is the study of Botturi et al. [3] and Niemi [15] where both studies stated that the use of digital storytelling media in learning could improve the quality of students, that is, to grow the skills of 21st-century.

The cognitive improvement of the two experimental classes is also influenced by the contextual approach that has been used in digital science storytelling. The contextual approach applied in this study refers to the opinions of Putra [18] and Komalasari [10] that is the combination of the seven main components of effective learning, namely constructivism, inquiry, modeling), reflection (reflection), and actual assessment (authentic assessment).

Johnson [9] suggested that the benefits of contextual learning are: (1) encouraging students to discover the meaning of learning, (2) cultivating cooperative and mutual respect, (3) fostering critical and creative thinking skills, (4) encouraging students to be active in learning. Wulandari [32] proves contextual learning can improve critical thinking skills and learning outcomes (cognitive and affective) of students. The learning process by applying contextual approach is more interesting so that the student's interest to learn [25]. These studies are by the results of research [7,11,13,19,27] wholly prove that contextual learning can improve student learning outcomes and make learning more meaningful.

4. Conclusion

Science digital storytelling can improve students' cognitive ability. The value of N-gain calculation is 0.48 for experimental class one and 0.42 for experimental class two. The improvement of students' cognitive ability of the two experimental classes was medium. The classical completeness of students' cognitive abilities in both experimental classes shows a significant improvement.

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