The Effectiveness Of Digital Science Scrapbook On Students' Science Visual Literacy

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THE EFFECTIVENESS OF DIGITAL SCIENCE SCRAPBOOK ON STUDENTS' SCIENCE VISUAL LITERACY

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ABSTRACT

This study aims to examine the effects of digital science scrapbook on students' science visual literacy. Digital science scrapbook was designed to teach junior high school students, and the instrument was designed to measure the level of visual literacy before and after the treatment. This study employed a quasi-experimental one-group pretest-posttest design. The population was junior high school students. The convenience sampling method was chosen to carry out the pilot study on 25 students in SMP 9 Salatiga. The visual literacy course was based on the ACRL Visual Literacy Competency Standards. The differences in visual literacy levels were measured through 30 items of the visual literacy test. After conducting paired sample t-test on the data, differences between pretest and posttest were found. From the findings, significant differences in pretest and posttest scores were found. It can be concluded that digital science scrapbook is effective to train digital literacy in science. The novelty of this research is the use of digital science scrapbook on students' science visual literacy.

Keywords: digital science scrapbook; science visual literacy

INTRODUCTION

Students are currently living in an environment filled with visual images, and without exception, the learning materials they learn. Students reside in a visually oriented era in which science and technology learning depend on images to present information. Learning materials have to compete for attention in a visual environment. As a result, all learning resources, from traditional textbooks to the latest learning technologies, contain many pictorial representations that vary significantly from realistic pictures and photos to very abstract diagrams and graphs (Chyleńska & Rybska, 2019). The emphasis on image-based learning is reflected in the widespread use of technical drawings by researchers and technology experts in various fields. Educators must introduce visual-oriented learning in all fields of study (Hattwig et al., 2013).

One particular subject that requires visualization is science. It discusses numerous objects and phenomena that could not be conceived through texts, for example, biochemistry learning. Besides studying the content, learners are encouraged to develop visualization skills to comprehend complex and abstract biomolecular phenomena (Schönborn & Anderson, 2006). Smith-Peavler et al. (2019) also explained that incorporating visual representation on natural and physical phenomena is a vital component in biology learning to assist students' understanding of the science content.

Learning science (biology, chemistry, and physics) using various pictures as a conceptual visualization requires 21st-century literacy skills that include computer literacy, media literacy,

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information literacy, and above all, visual literacy (Aberšek, 2008). Visual literacy is needed to perceive visual data in the multimedia text used to understand and interpret images correctly (Supsakova, 2016). This literacy is exceptionally essential for students and teachers in the 21st-century learning process. (Lundy & Stephens, 2015). Moreover, Semali (2017) argued that visual analysis creates unforgettable experiences and allows someone to internalize the learning.

Visual literacy will be learned well through favorable learning resources (Guinibert, 2020; Thompson & Beene, 2020). The statement is in line with Rybarczyk (2011) and Kędra (2018) that improvement of visual literacy could be achieved through several efforts like integrating primary textbooks with visual representations, visual-oriented worksheets, and visual-oriented learning activities, and the use of learning media as well as new technology (Kedra, 2018). In other words, teachers shall plan learning activities, materials, and the integration of new technologies to enhance students' visual literacy (Güney, 2019).

The use of visual images in learning is not state-of-the-art. It has been started since the day of blackboard and chalk color, then whiteboard and board marker, to flipcharts, posters, storyboards, charts, and many more. Currently, many education practitioners employ OHP and transparency. Nevertheless, the use of charts, graphs, and representational images in junior high school science textbooks remains very limited (Akcay et al., 2020). Hence, Kaya (2012) suggested that teachers enrich learning resources by using various visual learning media and activities to support the primary textbook to improve reading power and visual image reading skills. One way that visually literate teachers can do is creating quality and attractive visual images for science learning, for instance, by using PowerPoint presentations or computer-based instructions for web-based classes (Aisami, 2015).

A scrapbook is one of many media full of pictures. It is an album with creatively decorated pictures and stories related to learning materials (Rahmawati et al., 2020; Safaruddin et al., 2020). According to Damayanti (2018), this book-form album has several characteristics, including (1) a theme that is following the learning objectives, (2) items that focus on the subject matter, and (3) sufficient decoration.

There has been plenty of research on scrapbooks in science learning. For example, the Science Scrapbook Media (Veronica et al., 2018) and Physics (Sari et al., 2019) have been successfully developed feasibly and able to improve student science learning outcomes (Azizah et al., 2020). Safitri (2017) also revealed that the Science tale Scrapbook learning media positively affected student learning outcomes. The statement is parallel with Sari et al. (2020), who found that 3D scrapbook had a favorable effect on student learning outcomes and motivation. The scrapbook has also been shown to increase scientific literacy, especially on the concept of static fluids (Yuniar et al., 2020).

No one has used a scrapbook, particularly a digital scrapbook, to measure student science visual literacy. The use of this digital scrapbook is related to the research carried out by Cook et al. (2015), which stated that integrating visual elements and digital information technology with the STEM curriculum will provide more meaningful and understandable science learning. As technology changes very rapidly, and it has vastly important implications for teaching media evolutions (Chen, 2017). The points discussed in this section lead to the research objective, that is, to unveil the digital science scrapbook's influence on students' science visual literacy.

METHODS

This research was carried out based on the quasi-experimental one-group pretest-posttest design. It focuses on the effects of a digital science scrapbook on science visual literacy. Alam (2019) elucidated that pretest-posttest design is better than posttest only in measuring a lesson's success. This design was used due to research restrictions during the COVID-19 pandemic. It is following what was stated by Knapp (2016) that limitations do not bother the design as it is still effective for use.

The population was all 8th-grade students of SMP 9 Salatiga. Samples were taken by random sampling technique, and class 8F was selected.

O1 x O2
O1 = pre-test
X = the use of digital science scrapbook
O2 = post-test

The students had a pretest at the beginning of the meeting, and after four meetings using the digital science scrapbook, they carried out a posttest at the last meeting. Both the pretest and posttest were done via Google form. Each correct answer values 1, and an incorrect answer equals 0. The student scores calculation was based on the number of correct answers (100 as the total score).

Tests of visual literacy to measure the difference in visual literacy levels before and after treatment were designed using Bloom's taxonomy cognitive levels (Arneson & Offerdahl, 2018). Questions of visual literacy were given in 30 multiple-choice items (Slater et al., 2010; Offerdahl et al., 2017). An example of the item is shown in Figure 1.

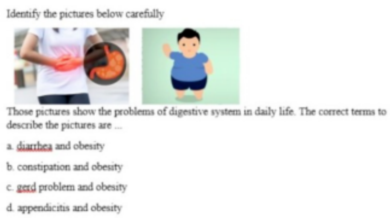

Figure 1. The Example of Science Visual Literacy Item

The science visual literacy test was validated by two content validators from the Integrated Science Department with a Biology Education background, in line with the media's materials, i.e., Digestive System. The test has sufficient internal consistency reliability measured by KR21 with a value of 0.8 (De Vaus, 2001; Arikunto, 2012).

RESULTS AND DISCUSSION

As shown in Figure 1, items of the science visual literacy test were arranged following junior high school students' cognitive level using Bloom's taxonomy in the form of multiple choices (Slater, 2010; Offerdahl et al., 2017; Arneson & Offerdahl, 2018) and based on Science curriculum for 8th-grade junior high school. The researchers had the Kolmogorov-Smirnov normality test on difference and applied parametric hypothesis test as the p-value suggests that the difference comes from a normal distribution.

Table 1. Tests of Normality

	Kolmogorov-Smirnova Statistic		
		df	**Sig.**
Pretest	.112	25	.200*
Postest	.162	25	.088

*. This is a lower bound of true significance.
Lilliefors Significance Correction

The Kolmogorov-Smirnov test results scored a significance level on the pretest and posttest, respectively 0.200 and 0.088, or > 0.05. Therefore, the data were normally distributed and continued to the paired t-test.

Table 2. Paired Samples Statistics

		Mean	**N**	**Std. Deviation**	**Mean difference**	**P-value**
Pair 1	Pretest	57.72	25	16.597	-18.840	0,0000
	Postest	76.56	25	6.007		

The researchers employed the paired samples t-test, and the significance level was set to 5%. The p-value (0.0000) of the test is under 0.05. Thus, the null hypothesis was rejected, and no difference between the means (H0: µPostest = µPretest), yet differences existed between the pretest and posttest scores (See Table 2).

The results showed significant differences in the pretest and posttest scores. It indicated that the students' science visual literacy level improved, considering the course's length. This improvement revealed that the treatment is appropriate and has the potential as a visual literacy media.

Table 2 informs the average of science visual literacy on students. The posttest was higher than the pretest. In other words, the 8F students' visual literacy was better after using digital science scrapbook. The researchers answer to the gap in knowledge about science visual literacy research which focuses on students through the pilot study. Indeed, this education implementation could be a starting point in studying different teaching materials' influence on visual literacy.

Digital science scrapbook as learning media interested the students in the learning process as it covers materials with attractive design and pictures (photos), as well as a video or a short movie fragment that further clarify the materials being taught. These items are either made by the student or provided from the internet (e.g., from YouTube) (Gosselink & de Man 2012). Scrapbooks make students learn science in a contextual manner relevant to students' daily lives and enhance scientific concepts based on interests and experiences to generate desire and interest in learning science (Phillip, 2007).

The scrapbook also contains exercise questions that have been adjusted to the visual literacy indicators and Bloom's taxonomy's cognitive level to stimulate the use of Bloom's Taxonomy at a higher level, especially analysis, evaluation, and creation. Growing science visual literacy in students will provide benefits both now and in the future, because visual literacy is pivotal to understand, analyze, and update a visual image (Yerlikaya & Yerlikaya, 2017). Visual-based learning contributes to the improvement of the science concept (Ainsworth et al., 2011; Binkhorst et al., 2015) and is a scientific discovery process, mainly when paying attention to the object being observed (Davies & McGregor, 2016) and is used in the discovery process (Lee et al., 2015).

The results revealed that teachers had an empirical knowledge about visual literacy in the digestive system topic, keeping in mind that no one got the minimum test score (0 points). This satisfying outcome happens due to the students' familiarity with visual communication in today's digital era (Matusiak et al., 2019). The students' previous and acquired knowledge could be evaluated using the digital science scrapbook before the pretest and after the posttest, respectively, to complement this study.

How well instructional design programs integrated visual literacy skills into the applied curriculum remains a question. Future instructional designers will be needed to develop e-learning modules as more learning are online in academia and the corporate world. The way to use visual literacy needs to be highly understood to create effective instructional programs. Therefore, it will be essential for instructional designers to incorporate visual literacy components into the curriculum as instructional experiences become more common through online learning systems. For that reason, future researchers must create e-learning modules that represent not only sound instructional design principles but effective instructional messages integrating visual literacy principles (Ervine, 2016).

In conclusion, it is pertinent to escalate teachers' and learners' awareness of the importance of visual literacy in learning and adopt appropriate teaching and learning skills. The situation will lead to visually-literate learners and enhance their learning performance. Therefore, curriculum planners, policymakers, school administrators, teachers, and, more importantly, school counselors are encouraged to focus on interventions that suit students' developmental needs (Afolasade & Nyong, 2018).

CONCLUSION

This study's primary objective was to design research that provides a concrete insight for students' science visual literacy training and a tool for evaluating their level. The results suggested that participants could enhance their visual literacy level quickly, and it can be concluded that if digital science scrapbook is effective to train digital literacy in science.

Finally, this study contributes to science visual literacy research focusing on the students' comprehension, which necessity for science visual literacy development through the years. The digital science scrapbook also contains exercise questions that have been adjusted to the visual literacy indicators and the cognitive level of Bloom's taxonomy. Further study on science visual literacy to students' learning outcome, especially Bloom's Taxonomy at a higher level, especially analysis, evaluation, and creation, would strengthen this digital science scrapbook.

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