

**ELECTRONIC COMICS IN ELEMENTARY SCHOOL SCIENCE
LEARNING FOR MARINE CONSERVATION****E. S. Syarah*¹, E. Yetti², L. Fridani³, Yufiarti⁴, Hapidin⁵,
B. Pupala⁶**^{1,2,3,4,5}Early Childhood Education Program of Postgraduate Studies, Universitas Negeri Jakarta, Indonesia⁶Departement of School Education, Trnava University, Slovakia**DOI: 10.15294/jpii.v8i4.19377**Accepted: July 20th, 2019. Approved: December 27th, 2019. Published: December 31st, 2019**ABSTRACT**

Marine education is essential in helping children to develop the knowledge, skills, and attitudes needed to preserve the environment, particularly for future coastal ecosystems. Effective marine education requires teachers to use proper strategies that will help children to value and care for the marine world. The purpose of this study was to determine the effectiveness of electronic comics to introduce marine conservation in elementary school. This study employed a quasi-experimental design model with paired t-test statistical analysis. The participants in this study involved three classes of elementary schools in Banten Province, Indonesia. There were 113 children and were divided into two experimental classes using electronic comics (laptops, computers, tablets, and mobile phones) and one control class using printed books. The results of this study showed a significant result in marine conservation knowledge of elementary school students in the experimental classes. In the control class, there was only a slight increase in the knowledge of marine conservation. The data analysis results revealed that children aged 6-8 years are more interested in learning using electronic comics compared to printed books. The findings also showed that elementary school students (aged 6-8 years) could recognize and comprehend marine conservation in science learning through electronic comics. The introduction to marine conservation could then be done using the latest technology that attracts children's learning interest.

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Keywords: electronic comics, elementary school science learning, marine conservation

INTRODUCTION

The use of the gadget in elementary school-aged children in Indonesia has been a habit in recent years. This phenomenon has become a challenge for teachers and parents to control the use of gadgets at home or school. Based on the research by Merga & Roni (2017), children generally employ gadgets for reading purposes, and the

frequency of reading was reduced when children have a higher chance of access to the gadget.

Research on the impact of accessible technology on learning, behavior, and family dynamics has lagged far behind using the gadget itself. Pediatric guidelines specifically related to the use of mobile devices by children have not been formulated (Radesky et al., 2015). This challenge showed the increased need to draw special attention to the rights of protection and care of children concerning the use of technology. Huda

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et al. (2017) examined the ways children adjust their technology skills and how they respond to media influences. This finding reveals that adaptive technology skills are needed to provide adequate guidance for children's protection and their involvement in digital information as part of their right to natural growth and development and proper supervision of the use of technology is one of the practical efforts (Connell et al., 2015).

The technology favored by children, in general, should be facilitated wisely by educators. Related to the improvement of children's knowledge and learning through screen-based digital books, Troseth & Strouse (2017) suggested that children be better at learning through interactive screens than only watching videos, gaming, or reading. This claim is drawn from the potential relevance of digital books to improve children's knowledge and literacy abilities. In line with this, Alzubi et al. (2018) revealed that the effectiveness of social strategies mediated by smartphone features and applications has an impact on the socio-cultural autonomy.

Indonesia, as a country with the most significant water area in the world, owns 12.5% of the world's total coral reef area ($\pm 58.000 \text{ km}^2$) (Susiloningtyas et al., 2018). Its rich marine biodiversity, endemism, and coastline naturally attract foreign and local tourists. However, these marine tourism areas are challenged by high-level plastic pollution and need restoration (Hakim et al., 2012).

Marine pollution and damage to Indonesia's marine biodiversity become a gap related to societies' knowledge of conservation in Indonesia. A study conducted by Fortes et al. (2018) showed that Southeast Asia has the highest diversity of seagrass species and habitat types. The extent of seagrass beds in Southeast Asia is $\sim 36,762.6 \text{ km}^2$. Nonetheless, this is invisible because ecoregions are not well represented and lack of renewal. For example, it has not been long after a news about the finding of a dead whale stranded in the eastern part of Indonesia, with its stomach contained a terrible plastic waste, including 115 drinking cups, 25 plastic bags, plastic bottles, two flip-flops, one bag and more than 1,000 pieces of rope (Parker, 2018).

Another problem that requires knowledge of conservation is waste pollution and debris in the Indonesian sea. Research conducted by Sur et al., (2018) implemented an education outreach program to involve primary and secondary school children in the scientific process using real issues of rubbish and marine debris on Indonesia's typical small islands (BarrangLompo, Spermonde

Islands, South Sulawesi). This program inspired a unique local perspective on waste in the sea that included greater awareness of the impact on human health and the need for realistic solutions to problems faced by all Indonesian people.

As verified by Dimopoulos et al. (2009), education had a significant influence on the cognitive level and attitudes of students. Parallel with this; some Indonesian educators have tried to save marine life and revive the concern of children for the Indonesian sea by sharing knowledge about marine conservation and waste management to children living in urban areas. However, this effort has not been adequately realized.

Indonesian education has not included the marine curriculum, especially for early childhood education. Inversely, Japan, as one of the archipelagic country, has had a grand design curriculum for elementary schools having one of the goals to promote a generous sensitivity to the ocean and develop an interest in the ocean. Activities designed are intended to raise awareness of the links between the ocean and familiar aspects of communities. According to Akiyama (2011), such a curriculum can be emulated by the Indonesian national curriculum team to be adapted following the Indonesian culture.

Young children are very motivated and curious about the world around them. Marine education in the early years of school must increase the innate capacity in children to learn from the natural world. This must be considered by giving a positive attitude towards and meeting with the sea and its surroundings.

The right choice of teaching media plays a vital role in the development of children's literacy. Supporting tools like a variety of toys, children, books, and magazines, software for Education, have to be carefully selected (Wildová & Kropáčková, 2015). Both printed and digital sources are employed, and it is a big challenge for parents and educators to find the optimal balance between the traditional literacy ideas (print) and recent (digital) literacy (Barzillai et al., 2018).

Visual narratives, such as comics and animation, are becoming increasingly popular as a tool for science and communication education. (Farinella, 2018). Felicia & Akinwamide (2018) discussed comics as visual media that are assumed by Yulian (2018) to influence the acquisition of knowledge as a result of learning. Both studies concluded that it could attract the interest and attention of learners in conveying information. According to Karakas (2012) and Herbst et al. (2011), comics provided a narrative experience for students who are just starting to read or

learning a new language as it scaffolds students' understanding.

Further, Nixon (2012) applied the strategy offered by Gary and Gerry as a guide for making scriptwriting in comics (a science concept that would be introduced to children). The study found out that drawing enhances students' narrative writing. Moreover, Aggleton (2019) defined what distinguishes digital comics from printed comics and explored the visual, functional, and sociocultural features of digital comics. This definition helps inform other specific work definitions of digital comics. Digital comics can be created through the Comic Life application. Educators in more than 80 countries have found Comic Life to be an excellent complement to their lesson plans for beginners and intermediate readers and writers. Comic Life is perfect for engaging reluctant readers and is appropriate for teaching visual literacy. Its easiness and fun have made Comic Life an excellent tool for all students (Herbst et al., 2011).

To the extent, Rvachew et al. (2017) compared the effectiveness of joint reading interactions through electronic and paper books to improve children's literacy in Canada. All results are significantly related to children's letter knowledge. There is more excellent literacy knowledge when using e-books compared to printed books, especially for children with poor letter knowledge. Thus, ebooks designed to facilitate adult reading strategies might ameliorate emergent literacy skills, especially in children with deficient skills at school entry. Research on the effect of early reading experience using digital texts explains the way digital technology is integrated into educational literacy practices, both in pre-school age and school age. The success of this integration requires attention from the education system, from children to educators, and through local and national education policies (Barzillai et al., 2018).

Digital gaming has been proven to support learning in many ways (Gillen et al., 2018). Marsh (2016) researched the use of tablets and children's applications in the UK. The study found out that children, even from a young age, could operate gadgets impressively as both authors and readers. They are also able to navigate technological devices with confidence and competence relative to their age. Furthermore, the influences of tablets and applications on the establishment of emergent literacy skills were investigated by Neumann et al. (2017). The outtakes indicated that tablets could indisputably reinforce letter and sound learning, as well as aspects of writing development. Maureen et al. (2018) argued that measurement

of both literacy and digital literacy has taken into account two critical considerations: (1) a focus on content and measured aspects, in order to be able to evaluate the effectivity of the designed activities; (2) establishing a non-time-limited procedure to put children in stressful situations.

Wouthuyzen et al. (2017) introduced coastal resource conservation education and to examine the perceptions of children aged 8-9 years (second grade), SDN 01 Pagi Pari Island, and also their parents in managing sustainable coastal resources. However, this study has not included technology and has not touched children living in urban areas. Besides, Sari et al. (2016) carried out research to educate the Mentawai community about environmental conservation through storybooks, picture books, and children's practicum books. Moreover, Lu & Liu (2015) adapted concepts from digital game-based learning to innovative marine learning design integrating augmented reality (AR) programs for lower grade primary school students. However, for education in Indonesia, this technology is still expensive.

This research serves as a complementary of other similar studies, i.e., the need for IT-based learning in early childhood education on marine education and its influences. A preliminary study was done earlier before conducting this research. It was performed in several schools in urban areas and near the coast to see what can inspire the potential of marine education in the early years of schooling; also, unveil some of the problems involved in marine education. The issues found included ignorance of marine education for early year (5-8 year) students, irrelevant teaching strategies, and inconsequential curriculum to develop various learning experiences that promote the acquisition of knowledge, skills, and attitudes about the marine environment.

The knowledge of conservation has become an urgent problem in the primary education curriculum in Indonesia, considering Indonesia as a country of the world's maritime axis. Based on the phenomenon that occurs in the digital age of children's knowledge of marine conservation, the authors formulated the objectives of this research; they are: (1) to determine the effectivity of electronic comics in introducing marine conservation in elementary school students; and (2) to see if electronic comics are more effective than printed books.

METHODS

This research belonged to the quasi-experimental study involving 113 elementary

school children aged 6-8 in Banten Province, Indonesia. The participated children studied in the same school, and they live far from the sea and coastal areas.

The knowledge of marine conservation was measured using tests. The quasi-experimental research step began with conducting a pre-test to determine each child's first marine conservation knowledge. The children were split into three classes; two experimental classes and one control class. Then the stimulation using electronic comics in two experimental classes was conducted at the time of science learning. On the other hand, the stimulation of the control class was carried out using printed books. These activities lasted for two months. After the treatment for each class ended, a post-test was held to see the improvement of the learners' understanding of conservation knowledge.

This study employed a quantitative research method through a quasi-experiment design. The data were collected using observations and tests by analyzing paired t-test statistical data in the SPSS program (Creswell, 2012). The three classes were compared using ANOVA testing to see the homogeneity between groups (see Table 1).

Table 2. The Pre-test and Post-test of Quasi-Experiment Design

Group	Pretest	Procedure (Treatment)	Posttest
Experimental I	O1	X1	O2
Experimental II	O3	X1	O4
Control	O5	X2	O6
	Marine Conservation Knowledge Test	Activities to Increase Marine Conservation Knowledge	Marine Conservation Knowledge Test

Information:

G: Group; O1: Pretest I; X1: Procedure (Treatment Using Comic Electronic); O2: Posttest; O3: Pretest II; X1: Procedure (Treatment Comic Electronic); O4: Posttest; O5: Pretest; X2: Procedure (Treatment using Print Book); O6: Posttest

The electronic comic content covered marine conservation, including three ecosystems; mangroves, seagrass, and coral reefs. Electronic comics resemble printed comics in general, using panels and word balloons yet tell more stories through pictures. By using the comic life application feature, comic compilers can insert original images from parts of the sea on comic content so that they look real.

The printed book used in the control class contains the same content, introduces marine life and conservation through a series of storylines. The difference between electronic comics and

Table 1. The Test of Homogeneity of Variances

Test	Levene Statistic	df1	df2	Sig.
Based on mean	2.667	2	110	.074
Based on median	1.168	2	110	.315
Based on median and with adjusted df	1.168	2	83.810	.316
Based on trimmed mean	2.254	2	110	.110

Based on the test of homogeneity of variances, the significance value was 0,74. Because the sig value 0,74 > 0,05, the variants in the experimental group I, experimental group II, and control group were homogeneous.

The research design used the pretest-posttest quasi-experimental design (Campbell & Stanley, 2015) by applying pre and post research steps, as well as taking samples randomly to make a class of intervention programs. (see Table 2).

printed books is the use of technology in electronic comics. In the experimental class I, the children were given various gadget facilities, such as mobile phones, tablets, and laptops with touch screen features. They could open the comic feature easily and read it by swiping the touch screen or by clicking the arrow to move the page. The text on the ballons could also be zoomed in and out quickly. In EC 2, the students were given electronic comics through the projector screen, and they read the comics together on the screen. Reading activities in the control class were carried out through the read-aloud technique by the

teacher, and the children touched and read the book directly. The data collected from the instrument grid were used as a standard measurement of marine conservation knowledge through the test in Table 3.

Table 3. The Grid of Marine Conservation Knowledge Instruments

Indicator	Item Number	Number of Items
Can explain the existence (classification), kinds of coastal and marine ecosystems, mangroves, coral reefs, and seagrass beds as well as how to maintain them	1,3	2
Can explain the condition of the coastal and marine environment and how to maintain it	2,4	2
Can explain the reciprocal relationship between mangrove ecosystems, coral reefs, and seagrass beds	5,7	2
Can provide examples of damage to the three important marine ecosystems, namely mangroves, coral reefs, and seagrass beds	6,8	2
Can express how many restrictions and appeals for sustainable management such as: 1) Appeal rules when snorkeling 2) Appeal rules for prohibiting the collection of living marine life 3) Appeal rules and prohibitions on taking marine biota in the DPL (<i>Daerah Perlindungan Laut</i> /Marine Protected Area)	9,11	2
Can explain the implementation of planting mangrove seeds to avoid abrasion	10,12,14	3
Can provide examples of the use of recycled bottle and plastic waste as handicrafts having economic value	13,15	2

The measurement tool for early childhood marine conservation knowledge has been tested by marine conservation experts, early childhood education experts, and biologists through empirical testing. The results are displayed in Table 4.

Table 4. The Pearson Correlation Results

Question	r-Value	r-table	Decision
1	0,569363	0,3009	valid
2	0,559293	0,3009	valid
3	0,73566	0,3009	valid
4	0,416277	0,3009	valid
5	0,741409	0,3009	valid
6	0,690891	0,3009	valid
7	0,62036	0,3009	valid
8	0,741409	0,3009	valid
9	0,359621	0,3009	valid
10	0,581197	0,3009	valid
11	0,559293	0,3009	valid
12	0,361895	0,3009	valid
13	0,690891	0,3009	valid
14	0,343306	0,3009	valid
15	0,407328	0,3009	valid

The results showed the validity of the instrument, which stated that 90% of the instruments are valid to measure marine conservation knowledge in early childhood as well as the empirical test results of statistical data by comparing r counts with r tables.

The reliability tests using the SPSS program (see Table 5) indicated reliable results on each test item used.

Table 5. Case Processing Summary

		N	%
Cases	Valid	31	100.0
	Excluded	0	.0
	Total	31	100.0

Listwise deletion based on all variables in the procedure.

Table 6. Reliability Statistics

Cronbach's Alpha	N of Items
.659	15

Based on the statistical reliability output table, the Cronbach's alpha value was 0.659. Then the value was compared with r-table with

an N = 31. The r-value was 0.3009, and the comparison of Cronbach's alpha and r-value was 0.659 > 0.3009. This showed a reliable research instrument to be used as a measure of marine conservation knowledge in early childhood.

Table 7. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Item 1	45.39	16.712	.241	.648
Item 2	45.84	16.340	.123	.671
Item 3	45.45	15.256	.469	.617
Item 4	45.71	15.946	.349	.634
Item 5	45.52	16.658	.173	.656
Item 6	45.48	14.591	.558	.601
Item 7	45.48	15.658	.305	.638
Item 8	45.94	17.062	.057	.675
Item 9	46.45	15.256	.320	.636
Item 10	45.81	14.495	.403	.621
Item 11	45.97	17.766	-.039	.681
Item 12	46.00	17.133	.031	.681
Item 13	45.87	16.116	.289	.641
Item 14	45.55	15.523	.541	.616
Item 15	45.55	15.523	.541	.616

The used learning curriculum design is presented in Table 8. It has been developed through the modification of learning strategies in early childhood classes. The learning design is essential to be planned carefully so that children are more comfortable in participating in the activities.

Table 8. Learning Curriculum Design

Learning Curriculum Design in Experimental Activities	
Learning goals	Children can capture and construct the meaning of learning messages on matters relating to marine conservation, including maintenance, repair, and sustainable management of coastal and marine ecosystems.
Learning strategies	Using the student-centered approach The ratio of teachers and children is 1: 7
Teaching materials	Electronic comics that have been developed (in the previous study) and validated Two kinds of learning media are presented. Gadgets were provided in the experimental class 1 and 2, while printed books were given to the control class.



Figure 1. Electronic Comics for Coral Reef Conservation



Figure 2. Electronic Comics for Mangrove Conservation



Figure 3. The Printed Book about Marine Life Science and Conservation

4 Learning time 20 minutes

RESULTS AND DISCUSSION

Quantitative Data

The data were analyzed using the paired t-test to test marine conservation knowledge improvement and hypotheses. Table 9 shows the results of the paired sample statistics, which viewed the average results of the conservation value before and after the treatment in the experimental class I.

Table 9. The Results of Paired Samples Statistics in the Experimental Class I

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	36.0645	31	3.65089	.65572
	Posttest	48.5484	31	4.16204	.74752

Table 10 shows the correlation between the pairs of variables given in the control class. This is a repeated-measurement analysis to expect a high degree of correlation between the two sets of scores.

Table 11. The Results of Paired Samples Test the Experimental Class I

Mean	Std. Deviation	Std. Error Mean	Paired Differences		t	df	Sig. (2-tailed)	
			95% Confidence Interval of the Difference					
			Lower	Upper				
Pair 1 pretest-posttest	-12.48387	5.60875	1.00736	-14.54118	-10.42657	-12.393	30	.000

Table 10. The Results of Paired Sample Correlations in the Experimental Class I

	N	Correlation	Sig.
Pair 1 Pretest & Posttest	31	-.027	.887

The hypothesis of testing the effectiveness of electronic comics media in the control class is as follows: (1) H_0 = There is no significant difference before (pre-test results) and after (post-test results) using electronic comics media; and (2) H_1 = There is a significant difference before (pre-test results) and after (post-test results) using electronic comics media. If the $t_{value} = 12,393$, $t_{table} = 2.660$ then, $12.393 > 2.660$ which means $t_{value} > t_{table}$, thus, the H_0 was rejected, and H_1 was accepted. In other words, there were significant differences before and after using electronic comics media on 31 respondents. Moreover, if the Sig (p-value), Sig. (2-tailed) = 1,93918E-23 Then, $1,93918E-23 < 0.05$. Hence, the H_0 is rejected, and H_1 was accepted. In sum, there were significant differences in the pre-test and post-test. The test results are presented in the following Table 11.

Table 12 indicates the results of the paired sample statistics, which show the average results of the conservation value before and after the treatment in the experimental class II.

Table 12. The Results of Paired Samples Statistics in the Experimental Class II

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest	35.3878	49	4.12218	.58888
	posttest	46.7755	49	5.62459	.80351

Table 13 shows the correlation between the pairs of variables in the control class. This is a repeated-measurement analysis to expect a high degree of correlation between the two sets of scores.

Table 13. The Results of Paired Sample Correlations in the Experimental Class II

		N	Correlation	Sig.
Pair 1	pretest & posttest	49	.321	.025

The hypothesis testing on the effectiveness of electronic comics media is as follows: (1) H_0 = There is no significant difference before (pre-test results) and after (post-test results) using electronic comics media; and (2) H_1 = There is a significant difference before (pre-test results) and after (post-test results) using electronic comics media.

Here we explain to one of the experimental classes, and the rest can be seen in Table 14. If $t_{\text{value}} = 13,723$, $t_{\text{table}} = 2.660$ then, $13.723 > 2.660$ which means $t_{\text{value}} > t_{\text{table}}$, hence, the H_0 is rejected, and H_1 is accepted. In other words, there were significant differences before and after using electronic comics media on 49 respondents. Furthermore, if the Sig (p_{value}), Sig. (2-tailed) = 1,93918E-23, then, $1,93918E-23 < 0.05$ so the H_0 is rejected and H_1 is accepted. In short, there were significant differences in the pre-test and post-test.

Table 14. The Results of Paired Samples Test the Experimental Class II

Mean	Std. Deviation	Paired Differences		t	df	Sig. (2-tailed)		
		Std. Error Mean	95% Confidence Interval of the Difference					
			Lower				Upper	
Pair 1 pretest-posttest	-11.38776	5.80882	.82983	-13.05624	-9.71927	-13.723	48	.000

Table 15 shows descriptive statistics of marine conservation knowledge for each class before and after the intervention. This table also explains the overall pre-test and post-test results of

two different treatments for testing marine conservation knowledge. In the two control classes, the data obtained were almost the same.

Table 15. The Descriptive Statistics of Marine Conservation Knowledge for Each Class Before and After the Intervention

Condition Class	Pre-test Mean	Post-test Mean
Control Class (n=33)	35.3939	38.3939
Electronic Comic Class I (n=31)	36.0645	48.5484
Electronic comics Class II (n=49)	35.3878	46.7755
Total (n=113)		

Qualitative Data

The qualitative data collection was done through interviews and observations with children. Additional data were also obtained from interviews with teachers. The following are

qualitative data obtained as the results of the e-comic reading activity. Some statements conveyed by the students after using the electronic comic have reflected their improvement in marine conservation. The statements recorded and the implication are presented in Table 16.

Table 16. The Students' Statements and Implication

Statements by the Students	Implication
"I no longer want to use straws, sorry for the sea turtle at sea."	Children understand that the straws they have been using will end up being rubbish at sea and can be caught in the turtle's breathing hole.

<p>“I just found out that small fish cannot distinguish which food is for them and which is plastic waste.”</p> <p>“The stomach of a dead whale is filled with plastic waste when it is stranded on land.”</p> <p>“Fishermen should not use bombs when catching fish, because the place where the fish feed their children will be destroyed.”</p> <p>“Adults should not cut mangroves for building materials; fish will not lose their homes.”</p> <p>“We should no longer use plastic drinking water bottles, and we must use refillable drinking bottles, existing plastic bottles should be recycled.”</p> <p>“I prefer learning with a laptop than a book.”</p>	<p>Children understand that plastic waste used in the city will reach the sea and is considered food by small fish.</p> <p>Children understand that even large fish can no longer be protected from the trash in the sea.</p> <p>Children understand that coral reefs are home for fish.</p> <p>Children understand that mangroves are also a place for fish to raise their babies.</p> <p>Children understand the sustainability program.</p> <p>Children consider technology as a more sophisticated way of learning compared to old models, especially books.</p>
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Other than that, the interview with the teachers also revealed that they require IT training to support learning that interests children of this digital-age. Moreover, they also thought that the government should regulate policies, mainly the national curriculum, that encourages marine education to rebuild the nation's maritime culture starting with early childhood education.

Research and experiments on electronic comics come from problems that exist in Indonesian society as a maritime country. Studies showed that Indonesian people have not yet fully possessed a maritime spirit and love for the ocean. One of them is seen from the results of research conducted by Winata & Yuliana (2010). There are still around 44% of the population on the coast of Pelabuhan Ratu Sukabumi, who have known the meaning of protection and conservation of marine resources. Then about 56% of the population does not understand the meaning of marine resources conservation.

The results of field observations showed that the control class had the highest average score on the item “read a picture,” but in other items, it scored lower than the experimental classes. It also found that the children's preferences for technology caused them to tend to prefer electronic comics compared to printed books. On the other hand, observation on the experimental class revealed the fact that children's interest in marine conservation escalated owing to the use of comics, which could attract children's reading interest even for those who were not able to read. Instead, they could interpret the pictures in the comic panel, through the expression of images.

The interest of children born in the digital age has made digital technology a supporting factor for the cultivation of marine education. At the moment, gadgets for early childhood are one of the reasons for parental worries and confusion,

because there are many cases of gadget abuse in early childhood. Nonetheless, proper utilization of gadgets has been reported to escalate learning outcomes. A study of 89 children at an elementary school in Taoyuan City, Taiwan which made use of a digital comic game, found that the examination results of students from the experimental group were significantly higher than the control group taught using the traditional teaching method (Chen et al., 2018). The findings have proved that the children's enthusiasm for electronic comic media makes them see tangible things to add to their insights, and thus increase their understanding of marine conservation in a short amount of time with a significant percentage.

Similarly, Suardi (2014), in his research on the use of the comic life application, unveiled the effectiveness of using the comic life application through reading activities on 32 respondents. The results of the study show that comic life contributed significantly to students' reading comprehension. The use of gadgets in early childhood is also suggested by Wang et al. (2010), who explained the way early childhood naturally learn about their environment through observation and accessible technology facilities. They suggested that instructional technology used in early childhood education supports the cognitive and meta-cognitive development process.

This study's development of comics is supported by expert supervision. Consultations with marine experts, educational experts, as well as biologists, were carried out to ameliorate the quality of the comics. These experts have involved in the conservation of natural resources in Indonesia; thus, their expertise should be undoubted. Additionally, the teachers' profound awareness of gadget usage has been one supporting factor in this research to facilitate the application content to be able to stimulate the students' marine

conservation knowledge and maritime cultural characters.

This study's findings also revealed the comics' influence on children's social emotions, and the most striking thing was excitement. According to the interview results with teachers, the children were very excited when they found out that the comic has been installed in the gadget. They like the colors in the comics, which they think are cute. They also like photographs showing the real things about marine conservation. Some children were also inspired to keep the ocean with what they can do, and this is the right start to strengthen the Indonesian generation's awareness of marine conservation as early childhood education is an essential time in children's lives. It is when they first learn how to interact with others, including peers, teachers, and parents, and also begin to develop interests, and set their way approach to learning as a part of their thinking skills. This basis will stay with them throughout their lives. In line with this, research by Hartley et al. (2015) examined the security of 176 British school children (ages 8-13 years) and examined the impact of educational interventions. After the intervention, children are significantly more concerned, have a better understanding of the causes and negative impacts, and reported being involved in more actions to reduce the potential causes of marine waste.

Nevertheless, some obstacles are still there — first, the inadequate gadget facilities, which may lead to children's impatience to queue. Second, the low score in the children's psychological influence. These are the points of revision in the application of comics in large groups. A big projector may be beneficial to be employed in a large class so that the reading activities can be done at the same time without queueing.

Electronic comics are said to be efficient because they cut a long marketing distribution path as in print media, which is initiated from the publishers to retailers. Its high mobility is also the striking point, that is, its ease in carrying out dozen of materials in just an application.

The most important finding of this research is the results of wise technological use for children. Technology is a non-separable thing for children in this digital age. A proper adult's knowledge, including teachers and parents, and profound contents, make a significant contribution to the beneficial use of technology in early childhood learning. These will also prevent adverse effects of gadgets for children.

Another significant result is the increase in the children's awareness of marine conservati-

on. The findings of the study through interviews showed that the children conveyed several expressions indicating the increased knowledge about marine conservation. The child felt sad to see a picture of a turtle with chronic wounds due to a straw stuck in the turtle's nose. Moreover, the children who tend to love animals seemed determined to cut waste in the sea, such as no longer asking for straws when eating in restaurants and using refillable drinking bottles. The children have also understood that when playing in coastal and marine areas, many rules must be obeyed to save marine creatures from supporting the life of the world. The children were also willing to draw pictures that show wishes to protect marine life, such as coral reefs, mangroves, or seagrass beds, and then shared with family, neighbors, or peers at other schools.

CONCLUSION

The study revealed that electronic comics of marine conservation could build knowledge of marine conservation in early childhood and inspire marine education in the early years of school (aged 5-8 years). The media has been proven to be feasible to be integrated into the current curriculum to marine studies. The authors of this study suggested that future researchers create a national curriculum profile to develop various learning experiences that promote the acquisition of knowledge, skills, and attitudes about the marine environment by looking at the resources available.

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