



## THE USE OF DIGITAL COMICS IN TORNADO MITIGATION FOR ELEMENTARY SCHOOL STUDENTS

**Nur Hidayati, Raniah Lintang Kinasih, Abdul Rokhman.**

Nursing Department, Faculty of Health Sciences, Universitas Muhammadiyah Lamongan,  
Lamongan, Indonesia

Corresponding Email: [nur\\_hidayati@umla.ac.id](mailto:nur_hidayati@umla.ac.id)

ABSTRACT	Keywords
Children are a vulnerable group in the face of disasters due to their age and limited knowledge. This study aims to analyze the impact of digital comic education on the preparedness of elementary school students in facing tornado disasters. The study was conducted using a quasi-experimental pre-test post-test with control group design on 90 elementary school students (46 in the intervention group and 44 in the control group). The intervention group received digital comics education (PDF), while the control group received education using PowerPoint media. Preparedness was measured using a questionnaire and tested using a paired t-test ( $\alpha \leq 0.05$ ). The results showed that 84.8% of elementary school students were in the less prepared category before intervention and increased to nearly prepared at 69.6% and prepared at 28.3% after education using digital comics. There was an impact of both digital comic and PowerPoint media education on increasing the preparedness of elementary school students ( $p=0.001$ ; $p=0.001$ ) with an average mean increase of 11.46 and 7.89, respectively. There was a difference in post-test preparedness between the control and intervention groups ( $p=0.019$ ). Digital comics proved to be more effective in increasing the preparedness of elementary school students in facing tornado disasters compared to PowerPoint media	<b>Digital-comics, disaster, preparedness</b>

### INTRODUCTION

Preparedness is an action taken during the pre-disaster phase (before the disaster occurs). The purpose of disaster preparedness is to reduce the risks (impacts) caused by a disaster (Widjanarko & Minnafiah, 2018). The research results indicate that the level of preparedness among elementary and Islamic

elementary school students in Karanganyar Regency is still low. This suggests that disaster knowledge has not been adequately conveyed to students in schools. Most students have never participated in training or socialization about tornado disasters. (Hadiyati & Hafida, 2018).

The National Disaster Management Agency (BNPB) recorded 2,627 natural disasters throughout 2023 (January - November 2023). The most dominant disasters were forest and land fires, followed by landslides, floods, and tornadoes. There were 1,616 incidents of forest and land fires, 340 landslides, 307 floods, and 292 tornadoes. The provinces contributing the highest number of incidents were Bali and Nusa Tenggara with 394 incidents, Sulawesi with 109 incidents, and Maluku with 87 incidents. According to the 2023 Indonesian Disaster Information Data, Sumatra ranks first in the number of tornado incidents, with 143 incidents, followed by Java with 103 incidents, and Sulawesi with 35 incidents. In Java, East Java Province had the highest number of tornado incidents compared to other provinces in Java, with 75 incidents. (BNPB, 2023). The Disaster Information Data of Indonesia (2023) records 7 natural disaster incidents in Lamongan Regency from January to November 2023. The predominant disasters were drought, occurring 4 times, followed by tornadoes with 3 incidents, resulting in damage to 14 houses and 1 school (BNPB, 2023).

Education can be conducted through several methods, including counseling, games, and the use of print media such as posters, leaflets, booklets, comics, and electronic media such as animated videos. The use of media in health education is crucial to support learning. Educational media can provide enjoyable experiences and cater to the needs of students, as each student has different abilities. Using media as a learning tool can make learning more effective, efficient, and engaging. (Andani, 2023).

Several educational methods have been implemented to enhance knowledge and preparedness among elementary school students, including crossword puzzle games focused on disaster preparedness knowledge

for elementary school students (Rahayuni et al., 2022). Puzzle games are effective in enhancing disaster preparedness knowledge among students at MI Fathul Ulum Sirau (Kholisoh & Aprilina, 2023). Both audiovisual methods and role-playing can influence disaster preparedness behavior in children (Sari & Suciana, 2019). The use of the disaster preparedness comic book “Komik Siaga Bencana (KOSIBA)” has an impact on flood knowledge and preparedness among students at MI Muhammadiyah Mujur Lor (Utami et al., 2022). The use of tablet media influences the knowledge and preparedness of elementary school students regarding flood disasters (Safitri, 2022). The provision of education through animated videos and simulations has an impact on disaster knowledge and preparedness among students at SDN Trucuk 1, Trucuk District, Bojonegoro Regency (Rahayu, 2021).

Based on the results of several studies mentioned above, there has been no research yet utilizing digital comic media as a disaster mitigation education tool. Therefore, the researchers are interested in employing digital comics as a medium for disaster mitigation education. The reason for choosing digital comic media is because it offers a different reading experience compared to printed comics. Considering that Millennials and Generation Z prefer using technology and gadgets in their daily lives, digital comics can potentially resonate more effectively with these generations.

Research carried out by Lazuardi & Kristiawan (2022) has been shown that children have increasingly been exposed to and become addicted to gadgets during the COVID-19 pandemic, as the government implemented Work From Home (WFH) policies to prevent and protect the public from virus transmission. As a result, educators and students were required to engage in online learning, leading students to rely more on gadgets than physical books.

Digital comics excel in terms of convenience in how they are read and are more economical compared to purchasing printed comics sold in bookstores (Ramadhan & Rasuardie, 2020). The use of digital comic media can create more active, creative, and innovative learning experiences, making the conveyed material easily understandable for students. This combination is expected to foster a serious learning environment while incorporating engaging visuals that keep students interested and prevent them from feeling bored or sleepy during the learning process (Narestuti et al., 2021). The research aims to analyze the influence of education using digital comic methods on elementary school students' preparedness in facing tornado disasters.

## METHOD

This study was a quantitative research with a quasi-experiment two group pre-test post-test with control group design. The research was conducted at Dlanggu Elementary School, Deket District, Lamongan Regency on April 15, 2024. The population of the study consisted of 100 elementary school students in grades 4, 5, and 6. The sample size was also 100 students who meet the inclusion and exclusion criteria.

The inclusion criteria included elementary school students aged 10-12 years (grades 4, 5, and 6), who had an Android smartphone and were part of a WhatsApp group, and are willing to participate as respondents. The exclusion criteria were students aged < 10 years and/or absent during the research. The entire sample was selected using total sampling technique from the total population of students in grades 4, 5, and 6, and then divided into two groups using cluster random sampling, with 46 students in the treatment group and 44 students in the control group.

The research instrument was using digital comics (in PDF format) created by the research team, consisting of cartoon images and text about tornado disaster preparedness, structured based on references from BPBD Denpasar and BPBD NTB, and has been registered with EC00202452057 Intellectual Property Rights on June 20, 2024.

The research instrument was a questionnaire on students' preparedness in facing tornado disasters, comprising 15 closed-ended questions with Likert scale responses ranging from 1 to 5, in which 1= unprepared, 2= less prepared, 3= almost prepared, 4 = prepared, and 5 = very prepared. This questionnaire was developed by the research team, referencing three parameters of tornado disaster preparedness from LIPI-UNESCO/ISDR (2006): knowledge, attitude, and emergency response planning.

The validity of the questionnaire was tested with 30 elementary school students from SDN Durikulon, Durikulon Village, Laren District, Lamongan, showing that the questionnaire was valid with a calculated  $r$  ranging from 0.424 to 0.655 ( $r$  calculated >  $r$  table 0.374). The reliability was also confirmed with a Cronbach's alpha value of 0.798 ( $\alpha$  > 0.60), indicating high internal consistency.

Before conducting the research, ethical approval for this study was obtained from the Ethics Committee of Muhammadiyah University Lamongan on April 9, 2024, with reference number 050/EC/KEPK – S1/04/2024.

Data collection was carried out by requesting information from students in grades 4, 5, and 6 at SDN Dlanggu who met the inclusion and exclusion criteria. Subsequently, students' data were randomized to determine their allocation into the intervention and control groups in a 50-50 ratio, based on odd and even numbers.

The research team then established a time contract with the school principal for the schedule of educational sessions. Informed consent was obtained from the students who agreed to participate, and they were asked to sign a consent form. The research was conducted over one day, from morning to afternoon, divided into 3 sessions. Five research assistants were involved to oversee and distribute the questionnaires to the respondents.

The first session was conducted with the intervention group, while the second and third sessions were with the control group. After distributing the pre-test, the intervention group received education through a digital comic about tornadoes distributed as a PDF via WhatsApp groups. Students were given 15 minutes to read and were guided to open the comic page by page (totaling 9 pages). Similarly, the control group received education through a PowerPoint presentation for 15 minutes, followed by closing with a post-test.

Before conducting statistical tests, the normality of the data was assessed using the Shapiro-Wilk test, which indicated a normal distribution of data ( $p = 0.124 - 0.608$ ). Subsequently, paired t-tests were conducted to measure the effect of students' preparedness before and after the intervention in both the treatment and control groups. An independent t-test was then performed to compare preparedness between the intervention and control groups.

### RESULTS

Total sample size involved in the study was 90 students, comprising 46 in the intervention group and 44 in the control group. During data collection, 10 students were absent without explanation, with 4 students from the intervention group and 6 students from the control group.

**Table 1. Respondent Demographic Data (n=90)**

Variable		Intervention		Control	
		N	%	N	%
Gender	Female	27	58.7	27	61.4
	Male	19	41.3	17	38.6
	Total	46	100.0	44	100.0
Age (y/o)	10	17	37.0	15	34.1
	11	9	19.6	10	22.7
	12	20	43.5	19	43.2
	Total	46	100.0	44	100.0
Class	4A	10	37.0	0	0
	4B	0	0	15	34.1
	5	9	19.6	10	22.7
	6A	20	43.5	0	0
	6B	0	0	19	43.2
	Total	46	100.0	44	100.0

Based on Table 1, respondents in both intervention and control groups are predominantly female (58.7% and 61.4%, respectively) and mostly aged 12 years (43.5% and 43.2%, respectively).

**Table 2. Student preparedness in dealing with tornado disasters before and after intervention**

Group	Preparedness	Pre-test		Post-test	
		N	%	N	%
Intervention	Unprepared	0	0	0	0
	Less prepared	39	84.8	1	2.2
	Almost prepared	7	15.2	3	6.9
	Prepared	0	0	13	28.3
	Very prepared	0	0	0	0
	Total	46	100.0	46	100.0
Control	Unprepared	1	2.3	1	2.3
	Less prepared	35	79.5	10	22.7
	Almost prepared	8	18.2	21	47.7
	Prepared	0	0	12	27.3
	Very prepared	0	0	0	0
	Total	44	100.0	44	100.0

Based on Table 2, the preparedness levels in the intervention group before receiving education is 84.8% categorized as less prepared, which decreased to 2.2% after the education. Meanwhile, 15.2% of students categorized as almost prepared

before education increased to 69.6% after education.

In the control group, 79.5% of students were categorized as less prepared before education, decreasing to 22.7% after education. Additionally, 18.2% of students categorized as almost prepared before education increased to 47.7% after education. There was one student in the control group, a 10-year-old 4th grader, who remained categorized as not prepared in both the pre-test and post-test.

**Table 3. Statistical Analysis of the Effect of Comic and Power Point Education on Student Preparedness**

Group		N	Min-Max	Mean±SD	p
Intervention	Pret	4	42	50.41±	0.0
	est	6	-	4.096	00
			63		
	Postt	4	52	61.87±	
	est	6	-	5.093	
			72		
Control	Pret	4	39	50.52±	0.0
	est	4	-	5.210	00
			60		
	Postt	4	39	58.41±	
	est	4	-	8.331	
			75		

The results of the paired t-test indicate significant impacts on preparedness before and after education using digital comics ( $p=0.000$ ), with a mean difference of 11.46. Similarly, there was a significant effect on preparedness before and after education using PowerPoint media ( $p=0.000$ ), with a mean difference of 7.86.

**Table 4. Comparison of Student Preparedness between Intervention Group and Control Group (n=90)**

Group	N	Mean±SD	p
Pre (Intervention)	46	50.41±4.096	0.912
Pre (Control)	44	50.52±5.210	
Post (Intervention)	46	61.87±5.093	0.019
Post (Control)	44	58.41±8.331	

The results of the independent t-test indicate that there was no significant difference in preparedness between the intervention and control groups before education ( $p=0.912$  or  $p>0.05$ ). However, there was a significant difference in preparedness between the intervention and  $p<0.05$ ), with a mean difference of 3.46.

## DISCUSSION

The research findings indicate that providing education using digital comics has proven effective in enhancing students' preparedness for facing the tornado disaster. There was an average mean increase of 11.46 points (from 50.41 to 61.87) among the intervention group receiving this education, demonstrating the efficacy of this method. Compared to the control group receiving education through PowerPoint presentations, the comic-based approach was deemed more effective in imparting understanding and readiness for the specific disaster. These findings are consistent with previous research (Andani, 2023) which shows the influence of providing comic book education on the preparedness for tornado disaster among elementary school students, with an average mean increase of 2.57 points (from 4.67 to 7.27).

Preparedness involves a series of disaster risk reduction activities aimed at anticipating disasters through organization and effective and efficient measures.

Insufficient preparedness can be attributed to students' lack of knowledge about disasters due to the absence of disaster awareness sessions or education in schools. Many schools still lack a curriculum specifically addressing disaster risk reduction materials (Rahayuni et al., 2022).

One effort to enhance students' knowledge and preparedness in facing disasters is through education. Education can be delivered through various methods such as lectures using leaflets, PowerPoint presentations (PPT), and gaming media like tabletop exercises, comics, *Sitangkar*, and other games.

Other methods proven to improve disaster preparedness among elementary school students include tabletop exercises, which have been proven effective in enhancing their preparedness for flood disasters ( $p = 0.001$ ) (Safitri, 2022). The game "*Sitangkar*" has been found to significantly influence the knowledge and preparedness of elementary school students in facing fire disasters ( $p = 0.000$ ) (Irfan, 2023). Research conducted by Nekada et al. (2023) demonstrates a significant impact of education and preparedness simulation on students' readiness in facing Mount Merapi eruption, both before and after the intervention ( $p = 0.00$ ), with a mean difference of 8 points (from 76.00 to 84.00).

The success of the learning process is considered good when students show improvement in learning outcomes. In teaching and learning processes that rely solely on lecturing, students often become passive listeners to the teacher's lectures, resulting in low learning outcomes (Kristianty & Sulastri, 2021).

The teaching-learning process aims to stimulate the intellect, emotions, attention, and abilities or skills of students, thereby facilitating the learning process. The Education Association (1969) defines instructional media as communication tools



in print or visual form, including hardware technologies and the positioning of instructional media. Given that the learning process is a form of communication occurring within a single system, instructional media holds a significant position as a component of the learning system. Without media, communication cannot occur, and consequently, the learning process, as a form of communication, cannot proceed optimally. Therefore, instructional media is an integral component of the learning system. (Luh & Ekayani, 2021).

The use of media in the learning process can evoke new interests and desires, ignite motivation, and provide stimulation for learning activities. Moreover, it can have a psychological impact on children. (Wasliyah et al., 2017).

Comics feature engaging visuals and colors that capture students' interest, making them more inclined to learn new knowledge because the instructional media used is more appealing. Comics also help develop students' ability to comprehend the material presented. Apart from being enjoyable to read, disaster comics serve as engaging tools for students to learn disaster preparedness and foster their reading interests.

Reading is a positive activity. In addition to broadening knowledge, regular reading strengthens human brain memory recall. Reading comics is an enjoyable activity where our fantasies soar along with the storyline depicted on each page. Comics are popular across all age groups, from children to teenagers and adults. This popularity stems from comics being entertaining and easy to understand. (Ayuwandira & Suprpto, 2022).

Digital comics, compared to traditional printed comics, have proven to significantly enhance students' preparedness as evidenced by a much greater difference in mean scores among students educated with

digital comics. Education through comics designed with images, colors, and text that convey messages engages children more effectively, encouraging them to observe and absorb information. This enables them to understand and successfully prepare for disasters such as the tornado. Additionally, digital comics can be accessed directly via gadgets, making them readily available for learning. School-age children's knowledge can be enhanced when explanations are delivered through engaging media, whether visual or audio-visual, allowing them to depict and understand based on what they see. (Maharani et al., 2021). According to Suyuthi (2011) in (Wasliyah et al. (2017), the use of visual effects, especially comics, in disaster preparedness education for children aims to increase their interest in learning how to prevent or cope with disasters.

## CONCLUSIONS

The use of digital comics has been proven to significantly enhance elementary school students' preparedness in facing tornado disasters compared to using PowerPoint (PPT) presentations. Future researchers are encouraged to integrate these comics into applications accessible to children, especially by creating cartoon versions to further stimulate children's interest and make them easily accessible via gadgets.

## LIMITATION

The comic used in this study is in pdf format and can only be accessed by students who have the file, and cannot be accessed globally on the website or online platform.

## REFERENCES

- Andani, A. (2023). Pengaruh Edukasi Melalui Komik Terhadap Kesiapsiagaan Bencana Angin Puting Beliung Pada Anak Usia Sekolah (Studi Di Sekolah Dasar Negeri

- Pangolongan 2 Kec. Burneh Kab. Bangka. *Jurnal Keperawatan*. <https://repository.stikesnhm.ac.id/id/eprint/1383/1/19142010053-2023-MANUSKRIP.pdf>
- Ayuwandira, C. D., & Suprpto, R. (2022). Perancangan Komik Interaktif untuk Memberikan Pemahaman Tentang Acute Stress Disorder di Lingkungan Keluarga. *Desainpedia Journal of Urban Design, Lifestyle & Behaviour*, 1(2), 73. <https://doi.org/10.36262/dpj.v1i2.646>
- BNPB. (2023). *Data Informasi Bencana Indonesia(DIBI)*. <https://dibi.bnpb.go.id/>
- Hadiyati, S., & Hafida, N. (2018). Urgensi pendidikan kebencanaan bagi siswa sebagai upaya mewujudkan generasi tangguh bencana. *Jurnal Pendidikan Dan Ilmu Sosial*, 28(2), 1–10. <https://doi.org/10.23917/jpis.v28i2.7374>
- Imanulhaq, R., & Ichsan, I. (2022). Analisis Teori Perkembangan Kognitif Piaget Pada Tahap Anak Usia Operasional Konkret 7-12 Tahun Sebagai Dasar Kebutuhan Media Pembelajaran. *Waniambey: Journal of Islamic Education*, 3(2), 126–134. <https://doi.org/10.53837/waniambey.v3i2.174>
- Irfan, N. M. (2023). Pengaruh Edukasi “Sitangkar” Terhadap Pengetahuan dan Kesiapsiagaan Siswa Pada Bencana Kebakaran di SDN Bedahan Desa Bedahan Kecamatan Babat Kabupaten Lamongan. Unpublish Skripsi, Universitas Muhammadiyah Lamongan.
- Kholisoh, N. A., & Aprilina, H. D. (2023). (2023). Efektivitas Edukasi Puzzle Kesiapsiagaan Bencana Banjir Terhadap Tingkat Pengetahuan Siswa MI Fathul Ulum Sirau. *Journal of Engineering Research*, 3(09). <https://doi.org/10.54543/fusion.v3i09.362>.
- Kristianty, D., & Sulastri, S. (2021). Pengaruh Metode Ceramah dan Dialog Terhadap Motivasi Belajar Siswa. *Jurnal MADINASIKA*, 3(1), 21–30. <http://ejurnalunma.ac.id/index.php/madinasiika>
- Lazuardi, D. R., & Kristiawan, M. (2022). Dampak Pandemi COVID-19 terhadap Kegiatan Belajar Mengajar Daring. *BIOEDUSAINS:Jurnal Pendidikan Biologi Dan Sains*, 5(1), 213–220. <https://doi.org/10.31539/bioedusains.v5i1.3064>
- LIPI-UNESCO/ISDR. (2006). Kajian Kesiapsiagaan Masyarakat Dalam Mengantisipasi Bencana Gempa Bumi & Tsunami. Jakarta : Deputi Ilmu Pengetahuan Kebumian Lembaga Ilmu Pengetahuan Indonesia. <https://unesdoc.unesco.org/ark:/48223/pf00000153617>
- Luh, N., & Ekayani, P. (2021). *Pentingnya penggunaan media siswa*. March, 1–16. Pentingnya penggunaan media siswa. Pentingnya Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Siswa, March, [https://www.researchgate.net/profile/Putu\\_Ekayani/publication/315105651](https://www.researchgate.net/profile/Putu_Ekayani/publication/315105651)
- Maharani, N., Kherismawati, N. P. E., & Setiawan, I. M. D. (2021). Sosialisasi dan Mitigasi Gempa Bumi Menggunakan Media Komik Edukasi Pada Panti Asuhan Dharma Jati I Klungkung Provinsi Bali. *Dharma Raflesia : Jurnal Ilmiah Pengembangan Dan Penerapan IPTEKS*, 19(2), 292–303.



<https://doi.org/10.33369/dr.v19i2.17098>

- Narestuti, A. S., Sudiarti, D., & Nurjanah, U. (2021). Penerapan Media Pembelajaran Komik Digital untuk Meningkatkan Hasil Belajar Siswa. *Bioedusiana: Jurnal Pendidikan Biologi*, 6(2), 305–317. <https://doi.org/10.37058/bioed.v6i2.3756>
- Nekada, C. D. Y., Christopher, C., Damayanti, S., Dewi, N. A. E., & Rahil, N. H. (2023). Edukasi Siswa Sekolah Dasar untuk Kesiapsiagaan terhadap Erupsi Gunung Merapi. *Jurnal Keperawatan*, 15(2), 671–680. <https://doi.org/10.32583/keperawatan.v15i2.853>
- Rahayu, D. P. (2021). Pengaruh Edukasi Vidio Animasi dan Simulasi Terhadap Pengetahuan dan Kesiapsiagaan Siswa SDN Trucuk 1 pada bencana Banjir di Kecamatan Trucuk Kabupaten Bojonegoro. Unpublish Skripsi, Universitas Muhammadiyah Lamongan.
- Rahayuni, N. W. A., Mertha, I. M., & Rasidin, I. G. A. (2022). Edukasi Dengan Media Permainan Teka-Teki Silang Dan Pengetahuan Kesiapsiagaan Siswa. *Jurnal Gema Keperawatan*, 15(1), 68–78. <http://ejournal.poltekkes-denpasar.ac.id/index.php/JGK/article/view/1933>
- Ramadhan, B. S., & Rasuardie, R. (2020). Kajian Industri Komik Daring Indonesia: Studi Komik Tahilalats. *JSRW (Jurnal Senirupa Warna)*, 8(1), 2–18. <https://doi.org/10.36806/jsrw.v8i1.80>
- Safitri, D. N. (2022). Pengaruh Edukasi Tabletop Terhadap Pengetahuan dan Kesiapsiagaan Siswa SDN Pilang Pada Bencana Banjir di Kecamatan Kanor Kabupaten Bojonegoro. Unpublish Skripsi, Universitas Muhammadiyah Lamongan.
- Sari, D. P., & Suciana, F. (2019). Pengaruh Edukasi Audio Visual Dan Role Play Terhadap Perilaku Siaga Bencana Pada Anak Sekolah Dasar. *Journal of Holistic Nursing Science*, 6(2), 44–51. <https://doi.org/10.31603/nursing.v6i2.2543>
- Utami, F. D., Agina, P., Suwaryo, W., & Yuniar, I. (2022). *The Effect of Disaster Awareness Comic Media (Kosiba) On students' Flood Disaster Preparedness At Mi Muhammadiyah Mujur Lor*. 635–645. <http://repository.urecol.org/index.php/proceeding/article/view/2484>
- Wasliyah, S., Keperawatan, J., Kemenkes, P., & Abstrak, B. (n.d.). Komik Bencana Meningkatkan Sikap Kesiapsiagaan Bencana Pada Anak Sekolah Dasar Negeri Bulakan Kecamatan Gunung Kencana Banten Selatan Tahun 2017. <https://doi.org/10.36743/medikes.v5i1.39>
- Widjanarko, M., & Minnafiah, U. (2018). Pengaruh Pendidikan Bencana Pada Perilaku Kesiapsiagaan Siswa. *Jurnal Ecopsy*, 5(1), 1. <https://doi.org/10.20527/ecopsy.v5i1.4878>