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International Journal of Curriculum and Instruction 17(3) (2025)
727–749

IJCI
International Journal of Curriculum and Instruction

Enhancing High School Students' Knowledge and Awareness of Disaster Readiness and Risk Reduction through Interactive Anime-Inspired Computer Simulation

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Abstract

The Department of Education (DepEd) has started increasing the knowledge and practices of the students in disaster readiness and risk reduction and preparedness (DRRR) by incorporating the DRRR learning course into the senior high school (SHS) curriculum. However, despite such an initiative, some students still lack interest in expanding their learning due to the conventional learning delivery. To address the learning problem, an anime-inspired learning material was proposed to make the learning process more interactive, engaging, relatable, and alive. Hence, using the quasi-experimental pretest-posttest research design, the study aimed to determine the effectiveness of the interactive anime-inspired computer simulation on enhancing high school students' knowledge and awareness of DRRR. Fifty (50) students from Grade 11 level participated in discussions with interactive anime-inspired computer simulation as learning support. Results revealed that Grade 11 students' knowledge and awareness of the DRRR were significantly increased. The three groups also advanced their knowledge of the various types of hazards and ways to manage the effects of the disasters. It was also indicated that there were significant differences between the formative test mean scores of the three groups. Likewise, there are substantial differences between the three groups' pretest and post-test mean scores. Moreover, Grade 11 students emphasized that their interest and attention span towards learning those topics were maximally maintained due to the game-oriented discussion and aesthetically appealing graphics. With these, it is suggested that teachers develop anime-inspired interactive learning tools to sustain students' interest in acquiring practical knowledge.

Keywords: Gamification, Disaster Risk Reduction, Computer Simulation, Anime-Inspired

1. Introduction

1.1 Introduce the problem

The Philippines' Department of Education (DepEd) has started increasing the knowledge and practices of the students in disaster readiness and risk reduction and preparedness (DRRR) by incorporating the Disaster Readiness and Risk Reduction learning course into the senior high school (SHS) curriculum (DepEd, 2016). However, despite the initiative to enhance the students' knowledge about disaster readiness and risk reduction, some still lack interest in the said course due to the conventional learning delivery. Some students even lost appreciation and drive to improve their competence in disaster resilience, resulting in low knowledge and awareness as teachers usually utilize the traditional discussion method.

Nowadays, technology has significantly improved students' knowledge and skills (Monserate, 2018; Francis, 2017). The advent of modern technologies has drastically improved the teaching and learning processes (Raja & Nagasubramani, 2018; Ghory & Ghafory, 2021); as such, educational institutions have leveraged these technological advancements to innovate strategies and interventions necessary for sustaining the delivery of quality education (Subramaniam & Subramaniam, 2017). In this era of globalization and modernization, it is crucial to consider how fast learners adapt to societal changes. Hence, in the context of teaching and learning, the use of traditional methods would no longer be effective for the present generation of learners (Raja, 2018). There is a dire need for integrating technology into the educative processes.

Using technology would help teach the Disaster Readiness and Risk Reduction course among high school students. Several studies show that students became more motivated, engaged, and interactive in their classes once the learning processes are aided by technological tools (Carstens et al., 2021; Ismail, I. A., & Hamarsha, 2020). As students' active engagement in class is a good predictor of students' learning (Delfino, 2019), teachers should innovate strategies using the available technologies to improve students' knowledge and awareness of disaster risk reduction and preparedness.

One effective way of augmenting students' interest and engagement is through the use of anime-inspired computer simulations. Anime is a Japanese art that most students feel excited about due to its sophisticated graphics and complex themes (Ruble & Lysne, 2010). In the Philippines, most high school students show high interest in watching anime series, particularly Tagalog-dubbed anime shows. The increasing interest of students in anime should be considered when developing an instructional tool. Adding anime-inspired elements would easily captivate students' attention and help them appreciate the content

even more. This can be done by using anime to teach salient topics in an interactive way which is expected to significantly affect the students' knowledge and awareness.

Therefore, this study employed an anime-inspired computer simulation to make learning more interactive, engaging, and alive. Moreover, the study aimed to determine the interactive anime-inspired computer simulation's effectiveness in enhancing high school students' knowledge and awareness of DRRR. Especially, this study aimed to achieve the following research objectives:

1. To determine the level of knowledge and awareness of the Grade 11 on of Disaster Readiness and Risk Reduction before using the anime-inspired computer simulation
2. To determine the level of knowledge and awareness of the Grade 11 on of Disaster Readiness and Risk Reduction after using the anime-inspired computer simulation
3. To examine the significant difference between the formative test mean scores of the tertiary students in the comparison and experimental groups
4. To examine the significant difference between the post-test mean scores of the tertiary students in the comparison and experimental group;
5. To analyze the significant difference between the pretest and post-test of each group
6. To examine the effects of the anime-inspired computer simulation to the level of knowledge and awareness of Grade 11 on of Disaster Readiness and Risk Reduction

1.2 ***Students' Knowledge and Awareness of Disaster Risk Reduction and Preparedness***

Disaster risk reduction and preparedness (DRRP) activities at the school level could be incorporated into curricular and extra-curricular programs. Likewise, it would be more effective if schools establish a disaster risk reduction management (DRRM) office that would be responsible for implementing, monitoring, and evaluating DRRM-related activities within the school. In this regard, schools in collaboration with the local government must heighten the implementation of Disaster risk reduction (DRR) programs and activities to increase students' knowledge and awareness.

A plethora of studies stressed the crucial roles of academic institutions in increasing students' knowledge and awareness of DRR (Nifa et al., 2018; Ivanov & Cvetković, 2014); Patel et al., 2023). In the study by Tabangcura et al. (2023), the students' level of DRR awareness were assessed, as it was opined as a significant concern that a school must take into consideration. Based on the study findings, the students were found to be unaware of the protocols and standards set forth by the local and national DRR agencies. This could lead to severe consequences once natural disasters occur. Similarly, Toyado (2022), in his study, unraveled the school-based disaster risk reduction management issues related to

students' low perception of disaster risks. These issues can be associated to certain variables such as preparedness, adaptation, and awareness.

Iqbal (2022) analyzed the disaster risk reduction awareness level among university students. Though the results revealed that most of the students are aware of the disaster risk reduction, they still believed that the government or university should conduct a mock exercise to prepare for geological disasters that may happen anytime in the future. Moreover, they emphasized the need to use various sources to promote disaster risk reduction awareness among university students.

Furthermore, Dwiningrum et al. (2021) found in their study that the students' average level of disaster knowledge did not reach the category of 50% good. This only calls for the need to augment the schools' efforts to improve students' disaster knowledge, as it plays an essential role in disaster mitigation. Disaster knowledge is crucial because it involves concepts such as policies, regulations, and guidelines necessary for disaster risk reduction management. It also includes knowledge about emergency responses and planning before and after a disaster.

Students' knowledge on disaster risk reduction can be affected by how it is integrated into the curriculum. For increase their knowledge and awareness, it is pivotal that students are immersed to various DRR-related activities such as preparedness drills and other capacity-building programs. Apart from this, another key consideration is the provision of teachers' training on implementing disaster risk reduction management.

1.3 Strategies in Improving Disaster Risk Reduction and Preparedness Among Students

Policymakers and managers should implement dynamic educational planning, needs assessment, and community-based educational strategies to improve disaster risk reduction and resiliency at the school and community levels (Aghaei et al., 2018). Implementing disaster risk reduction education requires sufficient educational resources and partnerships with concerned organizations; thus, schools should lobby legislators to enforce laws and policies for better and sustained disaster management.

In the study by Gökmenoğlu et al. (2021), concerns over the lack of disaster preparedness among teachers were pointed out. Their study focused on the teacher training program model to address the problem related to disaster education. Being prepared for future disasters is a significant concern of disaster management. As revealed in the study findings, implementing a school-based disaster education project improved teachers' knowledge and skills in terms of disaster risk reduction. Such a school-level

strategy must be imposed to help teachers to channel disaster-related information and competencies to their students effectively.

Relative to the above findings, Nakano & Yamori (2021) underscored the proactive attitude paradigm for disaster risk reduction education. This paradigm involves three approaches: instructor-learner fusion, community participation, and long-term commitment evaluation. These approaches concern the effective transmission of knowledge from the instructors to learners and active involvement in disaster-related activities.

1.4 Benefits of Using Computer Simulation in Teaching-Learning Process

Previous studies have demonstrated that using computer simulation in t teaching-learning offers many significant advantages. Firstly, it provides students with a dynamic and interactive learning experience that engages their curiosity and enhances comprehension. By visually representing complex concepts and processes, simulations make abstract ideas more tangible and relatable. Moreover, simulations facilitate experiential learning by allowing students to experiment and make mistakes in a risk-free virtual environment, promoting a deeper understanding of the subject matter. Additionally, these tools can be tailored to cater to diverse learning styles and individualized needs, fostering inclusivity in education.

Furthermore, computer simulations can simulate real-world scenarios, enabling students to apply theoretical knowledge to practical situations, thereby promoting critical thinking and problem-solving skills. Ultimately, the incorporation of computer simulations in education enriches the learning process and equips students with the skills necessary to thrive in an increasingly technology-driven world. While the use of computer simulations has been found effective in science education (Hannel & Cuevas, 2018); Çelik, 2022; Widiyatmoko, 2018), the number of published scholarly works on disaster risk reduction applications is still insufficient. Computer simulations help the delivery of instruction appealing, interactive, and collaborative. They offer modern tools that tap students' interest, curiosity, and problem-solving skills (Sahin, 2006). They can also be used as supplementary tools for laboratory classes and improving distance education.

Luo et al. (2016) designed an educational tool, the Web-based Interactive Landform Simulation Model-Grand Canyon (WILSIM-GC), to help students understand and appreciate landform development and evolution processes. The findings of their study revealed that the interactive simulation was effective for learning the landform development processes. Hence, the application of interactive simulation can be leveraged to improve students' learning. In addition, Kabigting (2021) evaluated the effects of computer simulations on high school students' learning of Physics concepts. The study

found that using computer simulation improved the students' performance in Physics. As a tool for delivering instruction, computer simulations help students connect their prior knowledge to new concepts in Physics.

Computer simulations also provide opportunities for students to understand concepts and processes better. Computer simulation enables the students to experiment as it resembles reality (Husain, 2010). With its animation program, computer simulation allows teachers to experiment with students. Similarly, computer simulations made it easier for students to transform abstract concepts into concrete ones (Niyigena & Nzabalirwa, 2022); thus, they enable learners to relate knowledge with real-life situations. Computer simulations can be used as alternatives for laboratory experiments in teaching and learning science.

In accordance with the findings as mentioned above, the advantages of computers have been leveraged by educational practitioners to address challenges in teaching and learning. Aside from games and drill practice, animation can also be processed with the computer- assisted instruction (CAI) package to induce students' motivation and interest (Gambari et al., 2014). Various studies reported the positive impact of animation on the students' visual attention (Kushwaha, 2019; Liu & Elms, 2019; Barut & Dursun, 2022). Due to images in motion, exaggeration, color, and actions, animations create visual humor that affects the audience's visual and psychological feelings (Praveen & Srinivasan, 2022). As it enables a broader range of stimuli, using animations in education is deemed significant in augmenting students' learning engagement.

1.5. Use of Japanese Anime in Designing Instructional/ Materials

Japanese anime, a captivating and visually striking form of animation that originated in Japan, has gained widespread popularity across the globe (Wahidati & Kharismawati, 2018). Anime's distinctive style, which is rooted in Japan's rich artistic heritage, has the potential to be leveraged in the design of instructional materials. Existing research suggests that anime can be a powerful tool in promoting socio-cultural values and aiding in the development of various skills and abilities among children and adolescents (Isa et al., 2015; Zin et al., 2010). The sheer scale of Japan's anime industry is a testament to the medium's significant commercial success and cultural impact from film, game, and merchandise agreements. Furthermore, anime's visual immediacy and boldness of vision, which can be traced back to Japan's classic scroll paintings and ukiyo-e woodblock prints, make it a compelling medium for engaging learners (Ye, 2023; Krikke, 2006). In fact, in the study of Annisa et al. (2022), it was found that anime is a very feasible teaching tool

for teaching media in grammar class. Similarly, Wisniawati et al. (2022) pointed out that anime enhances students' learning motivation and listening skills.

However, the literature on the specific use of Japanese anime in the design of instructional materials is limited. While studies have explored the potential of anime in shaping identity and imparting socio-cultural values, there is a dearth of research on how these unique visual and narrative elements can be effectively integrated into educational contexts.

Despite the growing popularity of anime and its widespread cultural influence, the existing body of literature does not adequately address the pedagogical applications of this dynamic art form. More research is needed to explore the ways in which the distinctive aesthetics, storytelling techniques, and thematic elements of anime can be leveraged to enhance instructional design and improve learning outcomes. Scholars should investigate the design principles and best practices for incorporating anime-inspired visual styles, character archetypes, and narrative structures into educational materials, with the goal of creating immersive and engaging learning experiences that foster a deeper appreciation.

2. Method

2.1. Research Design

To achieve the research objectives, the researchers made use of the quasi-experimental pretest-posttest research design. As shown in Figure 1, a pretest survey was conducted on the participants to determine their level of knowledge and awareness on disaster risk reduction before the application of the simulated tools.

These participants underwent a series of discussions with interactive anime-inspired computer simulation as learning support. Eight computer simulations discussing the concept of the disasters up to the types of hazards and their effects were developed. Formative assessments were employed to determine the students' learning progress in understanding the topics under the DRR learning course. Results of which were further validated through the use of observation and personal notes.

In order to determine the effectiveness of the proposed innovative learning tool, a post-test was then utilized. An awareness survey was conducted once again to determine if there has been an improvement in their understanding of the course. Supporting the quantitative results, a follow-up focus-group discussion (FGD) was conducted with the users. Questions focused on the individual learning experiences, challenges encountered, and possible opportunities that can be derived from using the interactive anime-inspired computer simulation.

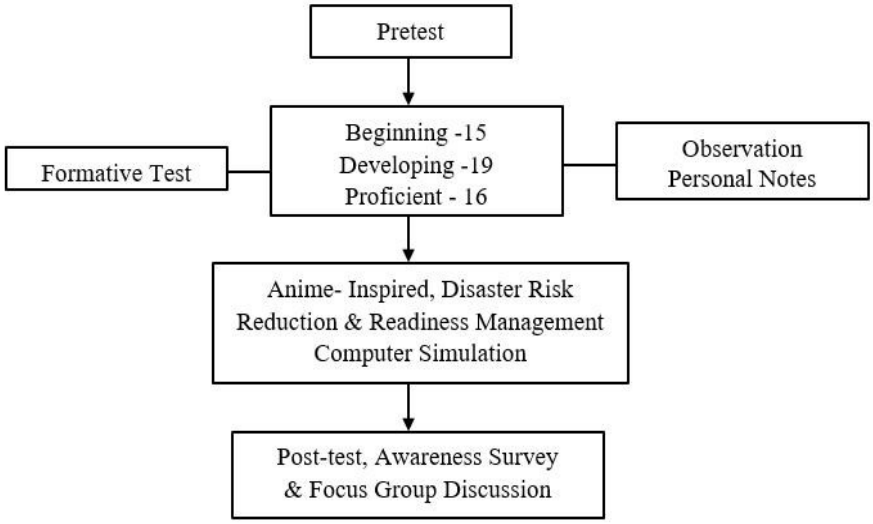

Figure 1. Quasi-Experimental Research Process

Research Locale and Participants of the Study

The study was participated by fifty (50) Grade 11 students at a public senior high school (SHS) in the City of Dasmarinas. Based on their accumulated pretest test scores through the match-pairing process, they were divided into three groups: beginning (15 students), developing (19 students), and proficient (16 students). The grouping of the students was done to clearly track their learning progress upon exposing them to the computer-simulated learning tool.

2.2. Data Analysis

Quantitative data were analyzed using both descriptive and inferential statistics. For the tabulation of scores in different assessment tools, descriptive statistics, particularly weighted mean and standard deviation were used. Inferential statistics such as Independent T-test and Paired t-test were employed to analyze the significant differences of the test scores. On the other hand, content analysis was employed to treat the qualitative data derived from the FGD and interviews (Bengtsson, 2016).

3. Results and Discussion

3.1. Determine the level of knowledge of the Grade 11 Disaster Readiness and Risk Reduction before using the anime-inspired computer simulation.

Table 1 shows the level of knowledge of the Grade 11 students on Disaster Readiness and Risk Reduction before using the anime-inspired computer simulation.

Results revealed that out of the total fifty (50) students, nineteen (19) were under the developing-level group, meaning that some students already manifest a minimum knowledge of the DRRR course. However, while they have already had working ideas for the course, some still need clarifications, explanations, and differentiation to deepen their understanding of the practical problems in a physical environment.

This is followed by sixteen (16) students who have shown proficiency in the DRRR learning course, meaning they have already developed a fundamental knowledge and core understanding of DRRR awareness. This group of students may exhibit such experience through practical application and context-specific knowledge utilization. On the other hand, fifteen (15) participants, who constitute the beginning-level group, still need to acquire adequate knowledge of DRRR learning. They exhibit a low-level understanding of the hazards, vulnerabilities, disaster management, and preparedness, shown in their test results. The results corroborated the study of Catedral Mamon (2017) in which he found that student's perception on disaster risk was low even though they understood some aspects of it. While they showed readiness, awareness, and adaptive mechanisms on the hazards caused by natural disasters, some issues concerning the DRRR still have to be emphasized among students.

Table 1. Level of knowledge of the Grade 11 on Disaster Readiness and Risk Reduction before using the anime-inspired computer simulation

Level	Frequency	Percentage
Beginning Group	15	30.0
Developing Group	19	38.0
Proficient Group	16	32.0
Total	50	100.0

Table 2 displays the Grade 11 students generally exhibited an awareness on the topics stipulated in the DRRR learning course module. As shown in the table, students were aware of the basic concepts of the disaster, risk factors, and effects of the disasters. This awareness may be attributed to the students' exposure to other learning areas such as science and social studies in which some concepts about disasters were initially introduced. On the other hand, some students showed slight awareness of vulnerability, its types, and effects on human welfare. Similarly, Tabangcura et al. (2023) found that while the students had a good awareness of DRRR, they manifested a low-level understanding in some areas of DRRR, such as its standards and protocols, programs, activities, structural resilience, and human resources.

Table 2. Awareness Level of the Grade 11 on Disaster Readiness and Risk Reduction before using the anime-inspired computer simulation

	Topics	Level of Awareness
1.	Basic Concept of Disaster and Disaster Risk	Aware
2.	Risk Factors Underlying Disasters	Aware
3.	Disasters and Its Effects	Aware
4.	Disasters from Different Perspectives	Aware
5.	Vulnerability	Slightly aware
6.	Vulnerability in Disaster	Slightly aware
7.	Vulnerabilities of Different Elements Exposed to Hazards	Slightly aware
8.	Effects of Hazard, Exposure and Vulnerability to Disaster Risks	Slightly aware

3.2. Determine the level of knowledge of the Grade on Disaster Readiness and Risk Reduction after using the anime-inspired computer simulation.

Table 3 shows the level of knowledge of the Grade 11 students on DRRR after using the anime-inspired computer simulation. Results showed that there is a significant improvement in the knowledge level of both developing and proficient groups as they reached the advanced level with a total of thirty-two (32) students. After using the DRRR gamified application. This is more than half of the population with 64% percentage value.

In addition, ten (10) students had a noticeable level of advancement from the beginning to the developing group. It is also worth noting that none of them were retained in the beginning-level group, which validates the positive changes brought about by utilizing the anime-inspired learning tool. On the other hand, eight (8) students get promoted to the proficient-level group from being part of either beginning- or developing-level groups.

Generally, the post-test results revealed significant progress among students' scores after utilizing eight (8) simulated applications of DRRR. Similarly, Celik (2022) further emphasized that teaching methods combined with computer-simulated learning materials make learning more concrete and effective.

Table 3. Level of knowledge and awareness of the Grade 11 (according Beginning, Developing, and Proficient groups) on Disaster Readiness and Risk Reduction after using the anime-inspired computer simulation

Level	Frequency	Percentage
Developing	10	20.0
Proficient	8	16.0
Advanced	32	64.0
Total	50	100.0

Table 4 reveals the improvement in the DRRR awareness level of the students. Students generally showed significant progress in their awareness level before and after using the computer-simulated learning tool. Their level of awareness on the first three DRRR topics has been elevated from just being aware to be very much aware. The five succeeding topics also generated a high attention from the respondents as their awareness level has been moved from slightly to very familiar. Such an increase verifies the meaningful interaction and positive response on the use of anime-inspired simulated tools. Similarly, Pasion (2020) found that junior high school students were aware of the risk reduction strategies during natural hazards such as typhoons, floods, landslides, and earthquakes. Also, Padernal & Borja (2016) revealed that students were more aware of the strategies for reducing risks caused by natural hazards, typhoons in particular, which occur in Surigao City.

The results revealed that majority of the respondents are grade 7, grades 8, 9, 10, 11, and 12 are much aware of risk reduction as to earthquake, typhoon, floods, and landslides, while grade 7 rated aware.

Table 4. Awareness Level of the Grade 11 on Disaster Readiness and Risk Reduction after using the anime-inspired computer simulation

	Topics	Level of Awareness
1.	Basic Concept of Disaster and Disaster Risk	Very much aware
2.	Risk Factors Underlying Disasters	Very much aware
3.	Disasters and Its Effects	Very much aware
4.	Disasters from Different Perspectives	Very aware
5.	Vulnerability	Very aware
6.	Vulnerability in Disaster	Very aware
7.	Vulnerabilities of Different Elements Exposed to Hazards	Very aware
8.	Effects of Hazard, Exposure and Vulnerability to Disaster Risks	Very aware

3.3. Examine the significant difference between the formative test mean scores of the Grade 11 students in the three groups

Four formative tests were administered to Grade 11 students to determine their learning progress to each topic after taking the DRRR gamified application. Each trial had ten (10) multiple choice-type questions assessing the students' understanding of the topics enshrined in every two modules.

Results indicated that three formative tests had significantly different results with p-values less than 0.01, as shown in Table 3. As reported in the table, the proficient group had a total mean value of 31.44, the highest score among three groups, indicating a significant difference. In the first formative test, the proficient group got the highest mean of 9.06 out of 10-item test. The developing group got an 8.16 mean score, which is relatively higher than the beginning group with a total of 5.20 mean score. During the interview, the proficient group revealed that they had had familiarity with some basic concepts and terms related to DRRR, resulting in high scores obtained from first test.

Noticeably, there was a significant decline in the scores of the three groups in the second formative test. Although the proficient group still got the highest mean, the mean score has been lowered by two (2) points. Likewise, the three groups obtained almost the same mean range in the third formative test. During the FGD, the students noted that the drop in mean scores in modules 2 and 3 may be attributed to acquiring new knowledge.

Since they were quite unfamiliar with the latest topics being discussed, students from the three groups experienced learning adjustments.

However, there was a significant increase in the students' test scores in the four formative tests. The proficient group maintained its highest score with 8.88 mean, while the developing and beginning groups obtained a score of 8.58 and 8.07, respectively. Since the groups' scores fall under the same range, the significance difference was not documented. Alhadlaq (2023) reported that computer-based simulation allows meaningful interaction with participants as they could work independently in a user-centered learning environment. It has resulted in a high-level of engagement and satisfaction for learning.

Table 5. Test of significant difference between the formative test mean scores of the Grade 11 students in the three groups

Test	Group	Mean	SD	F-value	p-value	Remarks
Formative Test 1 (Module 1)	Beginning	5.20	3.17	12.186	0.000	Significant
	Developing	8.16	2.09			
	Proficient	9.06	1.29			

	Beginning	4.00	1.93			
Formative Test 2 (Module 2)	Developing	4.74	1.24	18.194	0.000	Significant
	Proficient	7.06	1.29			
	Beginning	5.20	1.37			
Formative Test 3 (Module 3)	Developing	5.16	2.03	6.413	0.003	Significant
	Proficient	7.06	1.65			
	Beginning	8.07	1.53			
Formative Test 4 (Module 4)	Developing	8.58	1.02	1.803	0.176	Not Significant
	Proficient	8.88	1.02			
	Beginning	22.47	3.78			
Total Formative Test	Developing	26.63	2.83	27.321	0.000	Significant
	Proficient	31.44	3.60			

df = (2, 47); **Significant at p < .01

3.4. Examine the significant difference between the post-test mean scores of the Grade 11 students in the three groups

Table 6 summarizes the results for the post-test in the beginning, developing and proficient groups. Using the inferential statistical analysis tools, the post-test mean scores of the Grade 11 students in the three groups were found to be significant with a p-value of 0.000. The proficient group had the highest mean score with 22.56 and a standard deviation 2.80. The increase in scores may be derived from good interaction among students during the simulated classes. Collaboration and appreciation were observed. In his study, Talan (2021) concluded that collaboration in computer-based learning significantly positively affected knowledge gain, skill acquisition, and student perceptions. He emphasized that collaborative learning was more effective compared to individual learning.

Table 6. Test of significant difference between the post-test mean scores of the Grade 11 students in the three groups.

Test	Group	Mean	SD	F-value	p-value	Remarks
Post-test	Beginning	13.13	4.61	31.887	0.000	Significant
	Developing	20.79	2.97			
	Proficient	22.56	2.80			

df = (2, 47); **Significant at p < .01

3.5. Analyze the significant difference between the pretest and post-test of each group

The set of questions for the pretest was the same questions used for the post-test to determine if there had been any changes in the students' performance. Results indicated significant differences between the pretest and post-test scores in the three groups with a p-value of 0.000. This means that conduct of computer-simulated learning has significant effects on enhancing the learning productivity in DRRR. The positive effect of the simulated tool on the students' knowledge production was observed in the significant increase from the pretest to the post-test of the students. Thus, it is also assumed that the anime-inspired learning materials have maximized the students' potentials towards meaningful understanding of the concepts emphasized in the module since they accomplished several mental challenging activities. Tantamount to the results, Mutya et.al (2022) claimed that the use of Computer-Based Instruction is more effective than the conventional lecture method, as seen in the enhanced students' performance, signifying the effectiveness of the instruction using a computer in teaching.

Table 7. Test of significant difference between the pretest and post-test mean scores of each group

Group	Test	Mean	SD	t-value	p-value	Remarks
Beginning	Pretest	4.67	1.18	7.-555	0.000	Significant
	Posttest	13.13	4.61			
Developing	Pretest	10.47	1.22	-14.714	0.000	Significant
	Posttest	20.79	2.97			
Proficient	Pretest	13.94	1.00	-12.754	0.000	Significant
	Posttest	22.56	2.80			

$df_1 = 14$; $df_2 = 18$; $df_3 = 15$ **Significant at $p < .01$

3.6. To examine the effects of the anime-inspired computer simulation on the level of knowledge and awareness of the Grade 11 Disaster Readiness and Risk Reduction.

The researchers conducted an FGD and observation among selected respondents with equal representatives from the beginning, developing, and proficient groups. There were fifteen (15) students who conveyed their learning experiences, challenges encountered, and possible opportunities derived from using the anime-inspired computer simulation of DRRR. Presented are the following themes generated from the content analysis.

Relatable and Interactive. Five (5) students collectively agreed that one of the major strengths of the innovative learning tool is its relatability and connection to the users. Since several Filipino teenagers are exposed to the Japanese culture due to technological advancement, it was unchallenging for them to sustain their interest and attention span to the understand the concepts of DRRR using the anime-inspired computer simulation. The pictures, voice-over, videos, and choice of color made students feel a Japanese-like environment, allowing them to form social and emotional connections to the simulated materials, as shown in Figure 2.

Aside from that, three (3) of them emphasized that quizzes in the form of online games generated a meaningful interaction between the computer-simulated tool and the student, resulting in a high level of awareness of disaster-related issues. Their real-time responses to the animated activities made them more participative in learning salient features of DRRR as the elements of surprise and interactivity were noticeable. Chan (2017) mentioned that the utilization of anime in classroom setting provides opportunities for the teachers to connect with the students towards deepening their understanding of meaningful learning experiences. Similarly, Yıldırım (2021) confirmed that there was a significant improvement in the motivation and interest of the students in science education because of augmented reality implementation in teaching. They learned more enthusiastically and dealt with learning difficulties easily.

Figure 2. Japanese-like environment in computer simulation

Challenging and Enjoyable. Six (6) students divulged that the computer-simulated materials allowed them to struggle and monitor their progress as they unraveled the tasks included in each DRRR module. It also made them feel accomplished after finishing the task and getting a commendable score. Additionally, these students further explained that the mental leisure challenging activities obliged them to do association, critical thinking, remembering, and sequencing, which enhanced their concentration and mental agility and resulted in an in-depth understanding of types of hazards, effects of disasters on humans, and the concept of vulnerability as manifested in Figure 3. Computer simulations are practical learning

tools. Yehya (2019) emphasized that simulation coupled by the hands-on activities generates a better conceptual understanding and mastery of the topic.

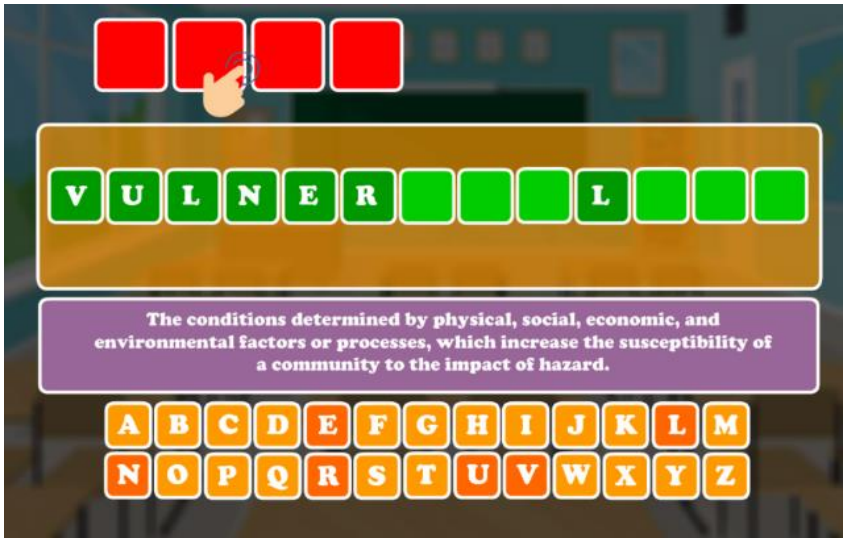

Figure 3. Sample of Mental Activity

Contextual and Fantastic. The aesthetically appealing graphics significantly contributed to the learning engagement of the students, as can be seen in Figure 4. The contextualized anime-inspired learning tool created a new reality in the students' mind, making them more creative, inclusive, and authentic. Four (4) students mentioned that the utilization of the said DRRR learning boosted their own imagination, creative intelligence, and convergent thinking leading to creating solutions that prototypically address disaster-related problems. The application of visual aesthetic and instructional design strategy is a key factor in creating instructional content, as shown in Figure 4. Ofosu-Asare (2017) claimed that learning has been influenced by the student's feelings and attitudes nurtured by aesthetics. The study emphasized that the aesthetic design and feature of the content delivery motivate the learners to become more passionate about learning the courses.

Figure 4. Creative Presentation of Information

Immersive and Relaxing. Unlike the other simulated learning tools available, the anime-inspired computer simulation nurtured a learning environment of relaxation where users can enjoy navigating the learning journey as it presents the complicated topics under the DRRR in a light and entertaining manner. Three (3) students also stated that immersive learning enables students to learn in replicated real-life scenarios that increase their self-efficacy and authentic learning, as illustrated in Figure 5. Their exposure to risk-free and safe learning space allowed them to carefully understand the important measures to be observed during disasters as stipulated in the DRRR course module. Elcokany (2021) discovered that exposure to life-threatening events through computer-based simulations allowed students to perform better and show higher achievement scores compared to the paper-based feedback.

Figure 5. Integration of real-life scenarios

Vocabulary Expansion and Cultural Appreciation. The spillover effect of utilizing the anime-inspired computer is a deepening appreciation of the Japanese culture. Five (5) students collectively shared that the presentation style has allowed them to settle in a different environment for a short time and learn some Japanese terms related to the DRRR as described in Figure 6. Due to climate and topography, Japan is one of the countries that are prone to natural disasters; therefore, teaching the DRRR in the context of Japanese provides a clear explanation of the vulnerabilities and safety precautions to be observed during the occurrence of natural hazards as it retells their countless experiences of typhoons, earthquakes, volcanic eruption, etc. Jimee (2019) further explained that despite being a country prone to multi-hazards, Japan has already advanced its practices in undertaking preparedness and mitigation measures to handle the disastrous events well. It has embarked on improving its Disaster Risk Management (DRM).

Figure 6. Japanese culture and language featured in the learning tool.

4. Conclusion

The study explored how the interactive anime-inspired computer simulation has been an effective tool in helping students enhance their knowledge and awareness of the Disaster Readiness and Risk Reduction course. Using the simulated tool exposed students to an interactive environment, which increased their engagement and curiosity, leading to a thorough understanding of DRRR topics. It also presented activities that challenge the learner's ability to think critically. Aside from enhancing knowledge and awareness, the anime-inspired tool has strengthened the students' appreciation of the Japanese language and culture, significantly contributing to their strong commitment to learning the DRRR topics.

5. Recommendations

With the results, the researchers recommend that teachers develop anime-inspired interactive learning tools to sustain students' interest in acquiring practical knowledge. They may also utilize computer-based learning applications to teach basic life skills and emergency preparation and response.

To further support the assertions regarding the positive effects on students' academic performance and appreciation, it is suggested that future researchers conduct mixed methods research to produce comprehensive sets of quantitative and qualitative data for examining the effects of anime-inspired computer simulation or similar simulated tools. Moreover, expanding the module to present conditions brought about by climate change and subsequent social issues and problems may be done to advance students' understanding of disaster management.

Acknowledgments

The authors would like to acknowledge the students of Francisco E. Barzaga Integrated High School for their active participation in the conduct of the study.

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