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Exploring the Problem-Solving Ability of Gen Z Gamers and Non-Gamers

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Abstract: *One of the results of modernization is the development of video games for enjoyment, socializing, and challenges. Though video games have been a source of debate in terms of their negative impact, they have been viewed as an instructional tool for improving various abilities, such as problem-solving. The researchers conducted a descriptive-comparative study to explore the problem-solving abilities of Gen Z gamers and non-gamers. Respondents were drawn from a state-run university's senior and junior high school students, consisting of 105 non-gamer and 105 gamer respondents. The researchers used a two-part instrument: the first part is about the respondents' profiles; the second part is the Solving Problems Survey. A T-test and ANOVA were used to evaluate the data. The results revealed that there was no significant difference in the problem-solving abilities of Gen Z when grouped based on their gaming status, gender, estimated weekly gaming hours, and preferred video game genre. Hence, the said factors have little or no impact on an individual's problem-solving ability. Future researchers may experiment with different approaches, instruments, and other methods to research on problem-solving and video games, or they may try to investigate different variables such as spatial skills, cognitive skills, memory, and so on.*

Keywords—video games; problem solving ability; gamers; non-gamers; descriptive-comparative

1. INTRODUCTION

Problem solving is an important skill, especially for young people, and it is not something that people are born with; it is something that develops over time. According to Coombs (2013), Generation Z are lacking in problem-solving and have not exhibited the ability to look at a situation, put it in a setting, analyze it and settle on a choice. Consequently, young people frequently make irrational decisions, and they require guidance as their brains develop, especially in managing desires and impulses in solving problems (Talukder, 2013). Moreover, adolescents struggle with life skills because they frequently lack opportunities to practice decision-making and problem-solving processes in their daily lives (RPC, 2013). Evidently, Gen Z, particularly adolescents, lack or have low problem-solving abilities.

To improve problem solving ability, it requires experience and practice, especially in a mathematics classroom for students. Accordingly, experience and practice will help individuals develop problem-solving, and Mathematics will help students improve the analytical and critical thinking skills required to solve problems (Kumar & Raja, 2019). In addition, students who practice specific mathematical problem-solving methods may learn how to solve problems successfully in a broader context later in life (Szabo et al., 2020).

Pehkonen et al. (2013) asserted that instruction must support the learner's problem solving and mathematical thinking in addition to calculation skills that are being taught in school. Furthermore, the role of mathematics in numerous countries is to foster students' understanding of mathematical structures and to develop mathematical thinking (Pehkonen et al., 2013). In the Philippines, the twin goals of mathematics education are critical thinking and problem-solving skills (DepEd, 2016).

Given the fact that there are learner-centered instructional approaches such as project-based and problem-based learning that allow learners to analyze a real-life problem to generate or design and develop a solution (Donnelly & Fitzmaurice, 2016), concerns have been raised that, despite these numerous strategies implemented by teachers, many students are struggling to understand and apply the concept of mathematical problem solving in real life (Malibiran et al., 2019). Findings by Pearce et al. (2013), show that the most cited reason for struggling with problem solving is the students' ability to read and understand the problem. This indicates that there is a need to implement a new strategy or tool to assist with the aforementioned problem.

The number of studies demonstrating how video games help improve problem solving (Adachi & Willoughby, 2013; Shute & Emihovich, 2018; Kumar & Raja, 2019) and the growing number of people actively participating in online gaming (Statista, 2021; Elliott, 2020), provide compelling reasons to investigate the phenomenon. Hence, the researchers explore the problem-solving ability of gen z gamers and non-gamers. Moreover, researchers test if there is a significant difference in the problem-solving ability of the respondents when grouped according to their profile, which includes gaming status, gender, estimated number of hours spent playing video games per week, and most preferred/played genre of video games.

To provide further detail on the study's context, several research and associated literature were analyzed. In this study, problem solving is defined in broader context, as to its application on day-to-day life. Problem solving according to D'Zurilla and Maydeu-Olivares (1995) as cited by Duerden et al., (2012) is a self-directed cognitive behavioral mechanism where an individual tries to find or discover useful or adaptive ways of dealing with difficult circumstances experienced in daily life. It is somewhat similar to the definition of Polya (1945 & 1962) as cited in DepEd (2016), that problem solving entails overcoming a difficulty, overcoming an obstacle, and determining a solution to an unknown problem.

Having a good and low level of problem-solving ability has different implications. Possessing good problem solving will help an individual easily adjust to new things and makes it easier to find solutions to every problem that the person encounters (Hooda & Devi, 2018). In contrast, low problem-solving skills are associated with the character of a young adult and influence impulsiveness or carelessness (Jaffee & D'Zurilla, 2009). Also, low problem-solving ability could be a main predisposing factor for depression among adolescents (Babaoglu et al., 2014).

Most of the adolescent have an average level of problem-solving ability (Sumitha & Rexlin, 2016; Baro & Paraon, 2017). But undeniably, young people who have average level of problem-solving ability are inconsistent in their approaches to problem solving. Moreover, according to Piaget (1950), as referenced by the American Psychological Association (2002), teenagers at their age are more cognizant of logically analysing the problem's sources and effects. They've also advanced to the point where they can evaluate the effects of their activities and forecast dangers (Office of Adolescent Health, 2018). Risk taking, on the other hand, is one of the most challenging aspects of youth development, and they do not always make the healthiest decisions. Furthermore, they are having difficulty choosing which course of action is the best.

There are several ways to improve in problem solving. According to Abazov (2016), to improve problem-solving skills, one must practice and exercise resolving the problem, and look for lessons to learn. Moreover, according to Kapur (2020), to build problem solving skills, one must gain experience, look out for ways to solve problems, cultivate critical reasoning, and produce as many ideas as possible.

Studies have been conducted to show that video games may or may not help in improving problem-solving abilities. As per Adachi and Willoughby (2013), video games are a helpful tool for the development of problem-solving skills. Moreover, based on the findings of Shute and Emihovich (2018), conducting research with the goal of improving twenty-first century competencies such as problem-solving skills for learners through immersive and engaging gameplay environments is relevant and important to undertake. In line with that, according to Kumar and Raja (2019), video and computer-based games have advantages, such as the ability to select various solutions to a challenging problem and then observe the effect of the decision, allowing users to experiment and exercise problem solving in a safe environment. In contrast, Rosenbaum and Burt (2017) looked at the statistical differences between gamers and non-gamers and concluded that there is no significant difference in response time or puzzle solving problems between gamers and non-gamers. Furthermore, Santos et al. (2019), found no significant differences in problem-solving abilities between gamers and non-gamers in terms of recognizing the problem, identifying feasible solutions, and implementing solutions after assessing the data. Hence, it is possible that abilities learned in video games aren't transferred to real-world situations (Unsworth et al., 2015 and Simons et al, 2016).

In the paper of Esposito (2005), video games are defined as a story-based game that can be a puzzle game, a toy game, or any other type of game that can be controlled by an audio-visual apparatus. According to him, an audio-visual apparatus is an electronic system with computing capabilities, input devices (controllers, mouse, keyboard, etc.), and output devices (screen, loudspeakers, etc.), such as an arcade video game, a video game console, a handheld console, a computer, a personal digital assistant, a phone, and so on.

In the Philippines, 81 percent of males and 73 percent of females stated they played online games, showing that males were more active in online gaming than females (Statista Research Department, 2020). Most of the gamers only play in moderation (Baro & Paraon, 2017; Dumrique, 2018). In genre preference, according to Baro and Paraon (2017), the puzzle genre is the most popular among gamers, whereas Chen (2019) claims that role-playing games are the most popular, and CIIT Philippines (2019) claims that action games are one of the most recognizable among gamers.

To further explore the influence of gaming on problem solving ability, it is essential to look on the implication of the number of hours spent playing video games in problem-solving. A study conducted by (Takeuchi et al., 2016) showed that more hours of playing video games for children is linked to lower verbal IQ and other negative changes in the brain which actively affects learning and other brain functions. However, a study by Posso (2016) shows that teenagers who play video games are more likely to get better grades in school where students who play online games almost every day scored higher than the average in Science and in Mathematics. Supporting neither Takeuchi et al. (2016) nor Posso (2016), a descriptive-comparative study conducted by Baro and Paraon (2017) shows that there is no significant relationship between problem solving skills and the number of hours spent playing video games. Hancock (2010) also found no substantial link between social problem-solving abilities and video game play time.

Another thing to explore is the influence of video game genre preference on problem solving, since there are studies which suggest that certain genres could provide cognitive benefits. Chen (2019) demonstrates that not all video games aid in the development of problem-solving abilities, some

games are just meant to be played for fun and leisure. Furthermore, only video games that feature a range of tasks, the need to work as a team, problem-solving tactics and approaches, and so on may assist players in improving their problem-solving abilities. According to Adachi and Willoughby (2013), the game genre has a significant impact on problem-solving abilities since their research discovered that strategic video game activity among high school students predicted self-reported problem-solving ability.

In line with the foregoing discussion, the researchers addressed and answered the following questions: (1)how may Gen Z gamers and non-gamers be described in terms of their gender, number of hours spent per week playing video games, and most played or preferred genre of video games?; (2) what is the level of the problem-solving ability of the respondents?; (3) and is there a significant difference in the problem-solving ability when respondents are grouped according to their profile?

2. METHODS

2.1 Research Design

A descriptive-comparative research design was used to differentiate the level of problem-solving ability of the gamers and non-gamers. According to Akhtar (2016), descriptive research aims to accurately portray the characteristics of a specific group or situation by answering the questions, what, who, where, how, and when. While in the comparison part, it is applied when two groups of people are compared and analyses the similarities and differences between them in order to better understand both groups (Drummond & Murphey-Reyes, 2017). Generally, in descriptive-comparative research, the researcher considers at least two non-manipulated variables and establishes a formal procedure for gathering criterion data to compare and conclude which of the two is better (L. Calmorin & M. Calmorin, 2005). The descriptive-comparative design is appropriate in this study because the researchers' goal is to describe the profile of Gen Z gamers and non-gamers as well as their level of problem-solving. Moreover, comparisons were made between Gen Z gamers and non-gamers to determine if there is a significant difference in the problem-solving ability when grouped according to their profile.

2.2 Respondents

The respondents in the study consist of 105 gamers and 105 non-gamers. The G-Power analysis was used to determine the 210 total samples with an effect size of 0.50 based on a 95% confidence level. The researchers selected from the Junior High School and Senior High School students of a state-run university. The purposive sampling method is necessary for researchers to properly select and approach qualified respondents (Palys, 2008). For non-gamers, the respondents should be: (1) ages 12-18, and (2) is not actively engaging in any form of online video games. Respondents for the gamers must be: (1) ages of 12 and 18, and (2) actively engaging in any form of online video games. The researchers then used convenience sampling after determining the likely respondents. Convenient sampling involves members of the target population who fulfil certain practical requirements, such as availability at a specific time or desire to participate Taherdoost (2016).

2.3 Instruments

To collect data from the respondents, the researchers used an instrument that has two parts. The first part of the questionnaire is made by the researchers to identify the profile of the respondents. It includes the gaming status, gender, estimated number of hours spent per week playing video games, and the most played/preferred genre of video games. The second part of the questionnaire was adopted by the researchers, which is the Solving Problems Survey modified by Baro and Paraon (2017). The scale consists of 24 statements with a 5-point Likert Scale: Never=1, Rarely=2, Sometimes=3, Often=4, Always=5. The solving problem survey evaluates the student's problem-solving ability by analyzing the frequency with which the following abilities are used: identify/define the problem (1–4), analyze possible causes or assumptions (5–8), identify possible solutions (9–12), select the best solution (13–16), implement solution (17–20), and evaluate progress and revise as needed. Items 5, 9, 15, 17, 20, and 22 will be reverse scores when getting the results (Never=5 to Always=1). The scores per item will be summed up together. The higher scores indicate greater ability at problem solving.

To ensure that the instrument is appropriate to answer the research questions, the researchers conducted face and content validity with the help of three professionals. The three validators asserted that the instrument will address the research questions. The researchers also conducted a pilot test with 30 respondents to establish a test of reliability which produces an internal consistency of .84 Cronbach Alpha.

2.4 Ethical Consideration

The researchers ensured that ethical standards and procedures were observed all throughout the research process. Before using the Solving Problem Survey, the researchers asked permission from authors Baro and Paraon by sending a formal letter through email. The researchers also ensured that all the publications that were used, are cited properly. The researchers also sent letters to the concerned officials of the state-run university to seek permission to conduct the study. The respondents were given the option of answering or not answering the survey, and the Data Privacy Act was included in the questionnaire. Furthermore, responders were assured that all information obtained will be treated with utmost confidentiality.

2.5 Data Analysis

To describe and present the profile of the respondents as well as the level of problem-solving ability, the researchers summarized the results through frequency distribution and percentage. The researchers conducted a priority test before

utilizing the T-test and ANOVA, which are the Kolmogorov-Smirnov Test of Normality and Levene's Test for equality of Variance. The T-test was used to understand whether problem solving ability differs between gamers and non-gamers, male and female non-gamers, and male and female gamers. Analysis of Variance (ANOVA) was used to examine significant differences in problem solving ability of gamers when grouped according to the estimated number of hours spent per week playing video games and the most played or preferred genre of video games.

3. Results and Discussion

This part includes the presentation, analysis, and interpretation of data gathered by the researchers. The results are presented according to the sequence of the research questions.

Table 1: Frequency and percentage distribution of the respondents according to gender

	Gender	Frequency	Percentage (%)
Gamers	Male	72	34.3
	Female	33	15.7
Non-Gamers	Male	31	14.8
	Female	74	35.2
	Total	210	100

Table 1 shows the gender of gamers and non-gamers. According to the data, male gamers outnumbered female gamers, with 72 (68.6%) being male. Also, according to the table, among non-gamers, there are 74 (70.5%) females. It shows that among gamers, there are more males and among non-gamers there are more females.

The results are consistent with the findings of Hainey et al. (2011) and Brand et al. (2017), which indicate that males are more interested in video games than females. The result is also congruent with the current data of Statista Research Department (2020), which found that 81 percent of males and 73 percent of females in the Philippines said they played online games, indicating that males were more involved in online gaming. Moreover, there are fewer male non-gamers than female non-gamers.

Table 2: Frequency and percentage distribution of the gamers according to the estimated number of hours spent per week playing video games

Number of Hours	Frequency	Percentage
1 – 5 hours per week	34	32.4
6 – 10 hours per week	19	18.1
11 – 20 hours per week	27	25.7
More than 20 hours per week	25	23.8
Total	**105**	**100**

Table 2 displays the estimated number of hours spent playing video games each week by gamers. According to the collected data, the range "1 – 5 hours per week" has the most frequency with 34 (32.4%) responses, while the range "6 – 10 hours per week" has the lowest frequency with 19 (18.1%) responses. Since “1-5 hours per week” has the highest frequency, it means that most gamers only play in moderation.

The finding is aligned with the result of Baro and Paraon (2017) where the respondents in their study are the gamer adolescents in Cavite City. The study shows that most gamers are spending 1 to 5 hours per week playing video games with the highest percentage of 68.5%. The case is also quite similar to the findings of Dumrique (2018) that gamers spend 3-5 hours during weekends in playing.

Table 3: Frequency and percentage distribution of the gamers according to the most played/preferred genre of video games

Genre of Video Games	Frequency	Percentage (%)
Action Genre	38	36.2
Adventure Genre	24	22.9
Puzzle Genre	9	8.6
Shooting Genre	13	12.4
Simulation Genre	11	10.5
Strategy Genre	10	9.5
Total	**105**	**100**

Table 3 shows the most played or preferred genre of video games of gen z gamers. Based on the table, “action genre” has the highest frequency of 38 (36.2%) and “puzzle genre” has the lowest frequency of 9 (8.6%). The table demonstrates that action games are the most popular video game genre among gamers, implying that they choose games that test their reflexes, hand-eye coordination, and response speed.

The result is not aligned to the findings of Baro and Paraon (2017) and Chen (2019), According to the study of Baro and Paraon (2017) puzzle genre is the most preferred genre of gamers. As per Chen (2019) role playing is the gamers most preferred genre of video gamers. On the contrary, the result is aligned with the report of CIIT Philippines (2019) that the action genre is one of the most preferred genres of video games according to gamers.

Table 4: Frequency and percentage distribution of the Gen Z gamers and non-gamers according to their level of problem-solving ability

	Low	Below Average	Average	Above Average	High	Total
Gamers	6	22	50	22	5	105
	2.86	10.48	23.81	10.48	2.38	50
Non-Gamers	8	21	44	28	4	105
	3.81	10.00	20.95	13.33	1.90	50
Total	**14**	**43**	**94**	**50**	**9**	**210**

	6.67	**20.48**	**44.76**	**23.81**	**4.28**	**100**

Table 4 illustrates the frequency and percentage distribution of respondents depending on their problem-solving ability. According to the data, the majority of Gen Z gamers and non-gamers had an average level of problem-solving ability, with a total frequency of 94, or 44.76 percent. It is also worth noting that 14 (6.67%) of the respondents have a low level of problem-solving ability, while 9 (4.28%) have a high level of problem-solving ability.

The table demonstrates that the level of problem-solving ability of both gamers and non-gamers is average. And interpreting the average level of problem-solving ability based on Table 2, it means that the majority of Gen Z are aware of the problem and recognize the value of a well-structured problem-solving approach, but they are inconsistent in their problem-solving approaches.

The results were identical to those of Baro and Paraon's (2017). According to the data, the average level has the maximum frequency of 61 (34.3 percent) and the lowest frequency of 5 for the high level (2.8 percent).

Table 5: Test of comparison between the problem-solving ability of gamers and non-gamers

	Mean	**Sd**	**t-value**	**df**	**p-value**
Gamers	93.85	7.33	.347	208	.729
Non-gamers	93.46	8.92			

Table 5 shows the t-test result between the problem-solving ability of gamers and non-gamers. The test shows that the p-value is .729 which is greater than the level of significance which is 0.05. Therefore, the decision is to accept the null hypothesis. There is no significant difference between the problem-solving ability of gamers and non-gamers. The results implied that an individual's gaming status has no influence on their problem-solving ability.

The findings are consistent with those of Santos et al., (2019), who found no significant differences in problem-solving ability between gamers and non-gamers in terms of identifying the problem, identifying viable solutions, and applying solutions. Sanbaum and Burt (2017) did a related study to look at the statistical differences between gamers and non-gamers. They discovered that there is no significant difference in response time and puzzle solving problems between gamers and non-gamers.

Table 6: Test of comparison on the problem-solving ability based on gender

		Mean	**Sd**	**t-value**	**df**	**Sig.**
Gamers	Male	93.68	7.21	.450	103	.654
	Female	94.21	7.68			
Non-gamers	Male	94.06	7.15	-.344	103	.732
	Female	93.20	9.60			

Table 6 shows the t-test result between the problem-solving ability of male and female with respect to gaming status. The test shows that both p-values which are .654 and .732 are greater than the level of significance which is 0.05. Therefore, the decision is to accept the null hypothesis. There is no significant difference between the problem-solving ability of male and females with respect to gaming status. The findings show that gender has no influence on problem-solving abilities regardless of gaming status.

The study's findings differ with those of Malibiran et al. (2019) and Sumitha and Rexlin (2016), where both studies showed that gender had a role in students' problem-solving ability. However, the findings on problem-solving ability for gamers by gender are comparable to those of Dindar (2018), who found no gender differences in video gaming and complex problem solving even though males had more experience and abilities in video gaming and spent more time playing video games than females.

Table 7: One-Way Analysis of Variance of problem-solving ability by estimated number of hours spent per week playing video games

No. of hours	**Mean**	**Sd**	**F-value**	**Sig.**
1 – 5 hours per week	93.91	7.17	.264	.851
6 – 10 hours per week	92.53	8.90		
11 – 20 hours per week	94.26	7.01		
More than 20 hours per week	94.32	6.89		

Table 7 presents the result of Analysis of Variance of the problem-solving ability based on the estimated number of hours spent per week playing video games. One-way ANOVA shows that p value =.851 which is greater than level of significance which is 0.05. Therefore, the decision is to accept the null hypothesis, there is no significant difference in the problem-solving ability of gamers based on the number of hours spent per week playing video games. The results suggest that the estimated number of hours spent per week playing video games has little or no direct influence on the individual's problem-solving ability.

The findings are consistent with those of the descriptive-comparative research done by Baro and Paraon (2017), which found no correlation between problem-solving abilities and time spent playing video games. Similarly, Hancock (2010) found no link between social problem-solving skills and time spent playing video games.

Despite the fact that gamers' problem-solving abilities do not differ significantly based on the estimated number of hours spent each week, the data reveals that those who answered spending 11-20 hours and more than 20 hours per week had higher means of 94.26 and 94.32, respectively. The findings back with Posso's (2016) findings that students who played

video games almost every day scored higher than the average in mathematics and science.

Table 8: One-Way Analysis of Variance of problem-solving ability by most preferred genre of video games

Genre Preference	Mean	Sd	F	Sig.
Action Genre	93.5789	8.01226	.171	.973
Adventure Genre	94.0417	7.85454		
Puzzle genre	93.4444	5.91843		
Simulation Genre	93.3636	8.05323		
Strategy Genre	95.8000	5.37070		
Shooting Genre	93.4615	6.77760		

Table 8 illustrates the result of Analysis of Variance of the problem-solving ability by the most played or preferred genre of video games. One-way ANOVA shows that the p value=.973 which is greater than the level of significance which is 0.05. Therefore, the null hypothesis is not rejected which indicates that there is no significant difference in the problem-solving ability of gamers according to the most played or preferred genre of video games. The findings show that video game genre preference has no effect on problem-solving abilities.

The findings do not support Chen's (2019) claim that certain video game genres can aid enhance problem-solving abilities. Video games, which feature a range of tasks, the need to work as a team, problem-solving tactics and approaches, and so on, can assist players enhance their problem-solving abilities, according to Chen (2019).

Regardless of the fact that there is no significant difference in the problem-solving ability when gamers are grouped according to genre preference, the data reveals that gamers who favor the 'strategy genre' have the highest mean of 95.80. The results supported Adachi and Willoughby's (2013) findings that strategic video games improve self-reported problem-solving ability because strategic video games often require players to gather information and plan a strategy before attempting to solve a problem, which may improve gamers' problem-solving abilities.

4. Conclusion and Recommendation

The findings of this study add up to studies about gaming and problem solving that was conducted. In the study, it was shown that males are more engaged in video games. Most gamers usually spend 1-5 hours playing video games per week and that the gamers only play for fun to ease their boredom whenever they have spare time. It was also revealed that the most preferred genre of video games is the action genre which shows that gamers preferred games that involve physical challenges, usage of weapons or tools and combat with other players.

Gen Z have an average level of problem-solving ability which means that most of the Gen Z are aware of the existence of a problem and recognize the value of a well-structured problem-solving approach. However, they are inconsistent in their approaches in solving problems.

Moreover, there was no significant difference in the respondents' problem-solving abilities when grouped according to their profile. It means that an individual's problem-solving ability is unaffected by gender, gaming status, hours spent gaming, or genre choice. Furthermore, gaming abilities may or may not be transferable or applicable in real life.

In lieu of the findings, teachers might involve a variety of instructional methods that put the students' abilities to the test. Since students are drawn to games, educators may wish to incorporate educational games that are related to their lessons to capture their attention. However, teachers should utilize the games in moderation and not allow them to become a distraction. Gen Z should either play games that are beneficial to them or play in moderation so that it does not interfere with their daily routines. If gaming abilities cannot be applied to real life, they should strive to learn new things or engage in other activities that will help them improve their problem-solving or other skills and abilities. Gamers should only play games in balance; they should also strive to discover other genres of games to see what they can acquire. Game developers, on the other hand, should try to make an educational action-based game, such as one with in-game quests related, such games that help players improve their social, cognitive, and other skills. Future researchers might experiment with alternative approaches, research designs, instruments, and so on to learn more about how problem-solving ability is being influenced by various factors such as video games. They may want to evaluate different variables in relation to video games, such as spatial skills, cognitive skills, social skills, memory, and perception.

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