

Effects Of Simulated Gamification On Empathy In Middle School Students: A Mixed Methods Study

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Abstract:

Background: Current understanding of effective interventions for teaching empathy is limited. Therefore, this study investigates the use of a simulation game as an instructional tool for developing empathy in middle school students. Using a mixed-methods design, this study examines the influence of a simulation game on the development of empathy.

Materials and Methods: Using a mixed-methods design, this study examines the influence of a simulation game on the development of empathy. In addition, the study examines students' perceptions of the simulated game through sentiment analysis using data mining techniques (Orange, Version 3.36.2; Demsar et al., 2013). Twenty-one students and their teacher from South Korea participated in an 8-week intervention. The game presented students with scenarios that required them to make life decisions in the face of adversity, and prompted them to reflect on their choices. Participants completed a 36-item questionnaire derived from Vachon and Lynam's (2016) Affective and Cognitive Measure of Empathy, and answered open-ended questions.

Results: Results indicated a significant increase in students' self-reported cognitive empathy, but not affective resonance and affective dissonance. Qualitative findings shed further light on students' sentiments toward different circumstances, in addition to their overwhelmingly positive feelings toward the simulated game.

Conclusion: This study concludes that simulated gamification as a teaching tool can enhance cognitive empathy in middle school students, highlighting the potential of serious games in empathy education.

Key Word: Simulated Gamification; Empathy; Middle School Students; Mixed Methods Study.

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I. Introduction

Over the past two decades, there has been a significant increase in mental health needs, and over the past three and a half years, the COVID-19 pandemic has exacerbated the social and emotional challenges faced by children. A research synthesis has shed light on this disturbing trend, revealing a notable increase in emergency room visits related to suicide attempts, suicidal ideation, and self-harm¹¹, especially during the pandemic. To illustrate the severity of the problem, in the United States alone, one in five children struggles with a mental health disorder such as anxiety or depression²³. Similarly, national data from South Korea indicate a parallel increase in feelings of sadness and rates of suicidal tendencies among adolescents during the COVID-19 pandemic²².

Educators recognize the critical importance of equipping students with the skills to manage their emotions and engage in socially appropriate interactions in a diverse classroom where peers come from different backgrounds and hold different beliefs. A constructive approach to achieving this goal is to emphasize life skills, which encompass the ability to gain self-awareness, foster a positive self-image, take responsibility for one's actions, and cultivate relationships with peers. This approach recognizes the process by which students effectively acquire and apply the knowledge, attitudes, and skills necessary to understand and regulate emotions, demonstrate empathy toward others, establish and maintain positive relationships, and make responsible decisions. There is substantial evidence that supporting students' well-being and life skills has lasting benefits, such as reducing the prevalence of depression and anxiety⁸.

One strategy for addressing the social-emotional skills needs of adolescents is to explore serious games. Serious games represent a novel approach that utilizes the engaging and interactive capabilities of digital gaming environments to promote educational outcomes²⁴. Therefore, this study aims to harness the potential of serious games to improve Korean students' empathy levels and their perceived attitudes toward different cultures and circumstances. In addition, this study explores students' feelings about the use of serious games in the classroom as a means to enhance empathy. By integrating the immersive nature of serious games, this study seeks to provide insight into their effectiveness as educational tools for promoting empathy and improving social-emotional competencies in adolescents.

Empathy, defined as the ability to share and understand another person's emotions, plays a central role in building social bonds and fostering a willingness to help others¹⁹. This emotional state not only deepens our understanding of others' situations, but also encourages us to consider their perspectives and needs²⁵.

Empathy, an essential facet of human interaction that is often overlooked in traditional educational approaches, revolves around the ability to understand the emotions of others¹⁴. Its importance is particularly evident when dealing with negative emotions such as suffering and pain¹². This concept is consistent with sociocultural theory, which posits that social interaction serves as the primary conduit for the development of cognitive skills, cultural values, and beliefs¹⁸.

In their seminal work, Wang and colleagues¹⁹ introduced the concept of ethnocultural empathy, which emphasizes the importance of understanding and connecting with people from different racial and ethnic backgrounds. This form of empathy integrates not only cognitive understanding but also emotional resonance, leading to effective communication. The present study extends this concept to include empathy toward individuals from different nations that transcends ethnic, racial, or linguistic barriers. We call this expanded concept "global empathy."

The challenge of fostering global empathy among young adolescents is exacerbated by the pervasive influence of in-group networks, such as Instagram, Facebook, and TikTok. While these platforms connect peers, they may inadvertently limit the effectiveness of traditional empathy-building approaches. In response, educators are increasingly turning to "serious games," which are designed primarily for educational purposes rather than mere entertainment. These games aim to foster empathy with individuals from different countries.

Serious games provide immersive environments and problem-solving challenges that foster social and emotional development. They cover a wide range of topics, including environmental issues, human rights, and international relations, and provide engaging, contextualized, problem-based learning experiences. These experiences are critical to increasing student engagement^{10,20,21}. Consequently, serious games can serve as a mediating tool for the development of social and emotional skills²⁴.

Games that are simulations also serve as powerful tools for experiential learning and social interaction. They create a supportive environment for practicing social strategies³, in contrast to the real world, which often promotes a culture where failure is not an option^{13,17}. Games allow for trial and error. Serious games that focus on social skills may require players to adopt multiple perspectives and actively collaborate with others to solve problems^{6,16}. In these immersive environments, empathy and cross-cultural understanding can grow, fostering individuals' social and emotional learning.

One notable example is the study by Bachen et al.², which explored the potential of simulated games to foster global empathy. Specifically, they examined how the use of an online game could allow players to experience life from the perspective of someone from another country. Their study involved 323 students from three California high schools, organized into 12 classrooms taught by four different teachers. Each classroom was randomly assigned to either a treatment or control group. The results showed that students who participated in the simulation game demonstrated significantly higher levels of global empathy than those in the control group. They also showed a greater interest in learning about other countries and expressed curiosity about issues relevant to different nations. However, the study had its limitations, including no follow-up with students or teachers and the relatively short exposure to the simulation game.

Another example is a study by DeRosier and Thomas⁶ that focuses on Hall of Heroes, a digital game designed to improve social skills training with young adolescents. The study examined the impact of the game on various aspects of social skills, such as communication, empathy, cooperation, and conflict resolution. The digital game involves navigating a school-like world and interacting with other characters. Participants were 26 middle school students in the United States. Researchers found that while behavioral and emotional ratings improved, there were no significant differences in parent-reported measures of interpersonal relationships and social problems.

Not all research has found positive results. For example, a meta-analysis by Zheng et al.²⁴, which reviewed studies published between January 2010 and May 2020 involving youth ages 5 to 19, reported mixed results. The analysis suggested that serious games have the potential to enhance social skills, but it also highlighted the scarcity of studies - only twelve - that focused on the role of serious games in social skill development. Although there is encouraging evidence from East Asian countries and studies involving minority groups in the United States, the bulk of the research has been conducted in the United States and Australia, primarily with samples that are mostly Caucasian.

One study that focused on the development of empathy in adolescents found no significant effects. Kral et al.⁹ examined whether a story-based game could help middle school students identify and respond to basic emotions. The video game helped students identify six basic emotions through an avatar's facial expressions and head movements. Players received feedback and had the opportunity to replay the game. The study involved 74 middle school students in the United States, 36% of whom were girls. Results showed that self-reported measures

of empathy did not differ significantly between the condition playing the story-based game and those in the control condition.

In another research, a study by Craig et al.⁴ evaluated the game Zoo U, in which children interact with virtual teachers and classmates to learn about animal care. In addition to learning, children receive feedback on their performance and gameplay, including personalized insights into the success or failure of their choices within the zoo. The study involved 47 mixed-grade students (28% racial minority, 41% girls) in the United States. However, the authors found no significant differences in the children's improvement in empathy. This lack of improvement in empathy may be due to the short duration of the intervention.

II. Material And Methods

Participants

The study was conducted in a classroom setting at a middle school in a rural area of South Korea. The total sample consisted of 21 seventh grade students, including 12 female students, representing 57% of the sample. All participants engaged in the simulated game under the guidance of their classroom teacher.

Simulated gamification

AllLives, a simulation game application, serves as an immersive life simulation platform that allows players to explore the multifaceted lives of individuals living in developing countries. This interactive medium allows students to engage with representations of real-life events and challenges. As participants navigate through these scenarios, they are forced to make decisions that have real-world consequences. Through this experiential learning process, students not only gain knowledge about the adversities faced by individuals, but also cultivate a deeper understanding and appreciation of their own cultural contexts while gaining insight into the cultures and realities of others.

AllLives was implemented as an 8-week classroom intervention in which students engaged in the simulated online game at their own pace during allotted 50-minute sessions. The intervention emphasized the following instructional components: (1) fostering empathy through a gamified simulation that provides students with an authentic exploration of real-world experiences, (2) increasing world knowledge by facilitating the sharing of experiences, and (3) creating multiple opportunities for positive interaction. After engaging in the online simulation, students were instructed to reflect on the decisions they made within the game, reinforcing the instructional goals of empathy and cultural awareness.

Measure

Empathy was assessed using a 36-item scale from Vachon and Lynam's¹⁶ Affective and Cognitive Measure of Empathy (ACME) questionnaire. A list of these items can be found in Table 1. The ACME questionnaire consists of three subscales, with each subscale consisting of 12 items: cognitive empathy (COG), affective resonance (RES), and affective dissonance (DIS). COG refers to recognizing what others are feeling-the basic ability to recognize emotional displays, RES involves the emotional response an individual displays (e.g., concern, sympathy, and compassion), and DIS assesses one's experience of conflicting emotional responses (e.g., taking pleasure in others' pain or being upset by others' happiness). Taken together, the items and their subscales compose the total empathy.

Each subscale was administered on a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree, with higher scores indicating greater levels of empathy. Table 2 reports reliability for these subscales ranging from .75 to .92.

Table no1: Affective and Cognitive Measure of Empathy¹⁶

No.	Item
1.	I have a hard time reading people's emotions.
2.	I think it's fun to push people around once and a while.
3.	I can tell when someone is afraid.
4.	It's obvious when people are pretending to be happy.
5.	I love watching people get angry.
6.	I enjoy seeing strangers get scared.
7.	It makes me feel good to help someone in need.
8.	I get excited to give someone a gift that I think they will enjoy.
9.	I usually understand why people feel the way they do.
10.	When my friends are having a good time I often get angry.
11.	People who are cheery disgust me.
12.	I don't worry much about hurting people's feelings.
13.	I don't really care if other people feel happy.
14.	I have a hard time figuring out what someone else is feeling.
15.	I can tell when people are about to lose their temper.
16.	I can usually predict how someone will feel.

17.	I don't really care if people are feeling depressed.
18.	I like making other people uncomfortable.
19.	I get a kick out of making other people feel stupid.
20.	When my friends get angry I often feel like laughing.
21.	Sometimes I enjoy seeing people cry.
22.	Other people's feelings don't bother me at all.
23.	I feel awful when I hurt someone's feelings.
24.	Other people's misfortunes don't bother me much.
25.	I can usually tell how people are feeling.
26.	Sometimes it's funny to see people get humiliated.
27.	If I could get away with it, there are some people I would enjoy hurting.
29.	If I see that I am doing something that hurts someone, I will quickly stop.
30.	I often try to help people feel better when they are upset.
31.	I enjoy making others happy.
32.	I am not good at understanding other people's emotions.
33.	People have told me that I'm insensitive.
34.	I can usually guess what's making someone angry.
35.	People don't have to tell me when they're sad, I can see it in their faces. 35 I find it hard to tell when someone is sad.
36.	I admit that I enjoy irritating other people.

Note.

Cognitive Empathy (COG) = 1, 3, 4, 9, 14, 15, 16, 25, 31, 33, 34, 35; Affective Resonance (RES) = 7, 8, 12, 13, 17, 22, 23, 24, 28, 29, 30, 32; Affective Dissonance (DIS) = 2, 5, 6, 10, 11, 18, 19, 20, 21, 26, 27, 36.

The following items were reverse coded: COG (1, 14, 31, 35), RES (12, 13, 17, 22, 24, 32), and DIS (2, 5, 6, 10, 11, 18, 19, 20, 21, 26, 27, 36).

Table no2: Reliability of Subscales

Empathy	<i>k</i>	Cronbach's Alpha
Cognitive empathy (CE)	12	.84
Affective resonance (AR)	12	.75
Affective dissonance (AD)	12	.84
Total	36	.92

Note. *k* = number of items; *r* = correlation

The present study also used interviews and open-ended questions directed to the students about their use of the simulated game. Examples of questions included the following: How do you feel about using the simulation game to increase your understanding of empathy? Share your attitudes about the online simulation game. In what areas do you see room for improvement?

In addition to the students' perspective, the classroom teacher provided her experience in implementing the online simulation game. The purpose of the qualitative component of the study was to gain comprehensive insight into the intervention under study.

Procedure

The classroom teacher first administered the Affective and Cognitive Measure of Empathy (ACME) to all students in a middle school classroom to establish a baseline of empathy prior to any intervention. Students were then given instructions on how to use a simulated game designed to enhance empathy. The ACM measure of empathy was administered again to assess any changes in students' empathy levels, allowing for a comparison of pre- and post-intervention empathy scores. In addition, students were asked to answer open-ended questions within the ACM instrument designed to elicit qualitative feedback about their experience with the intervention.

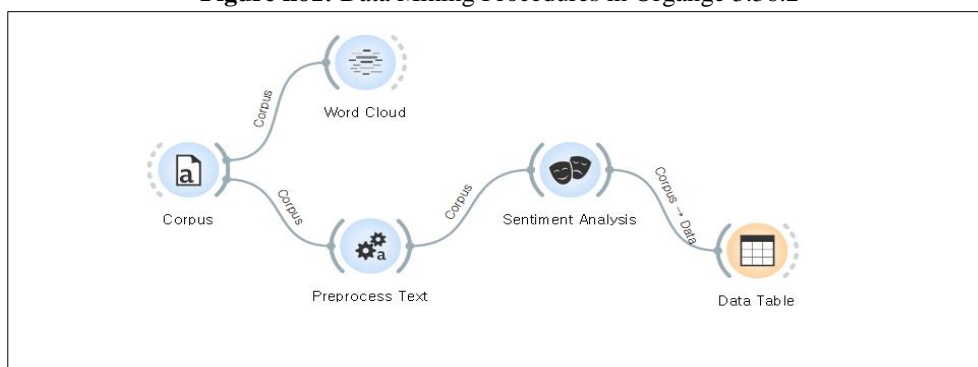
Data analysis

Descriptive statistics were computed for all subscales of empathy scores, followed by Pearson correlation analyses to examine the relationships between these variables. A paired sample t-test was then used to determine whether there were significant differences in the means of the empathy scores across the different empathy orientations before and after the intervention. The paired sample t-test evaluates the difference in the means of two empathy variables measured on the same cohort of individuals, comparing these differences to a null value and accounting for the non-independence of the observed values¹.

Furthermore, to enhance the understanding of participants' perception of simulation games, this study used qualitative content analysis on responses to open-ended questions. This methodological approach allowed for an in-depth exploration of participants' experiences and reflections on the use of simulation games for empathy development. Lastly, sentiment analysis, a specialized area within the field of natural language processing (NLP) that focuses on identifying and categorizing opinions expressed in text, was applied to analyze students' attitudes

and perceptions regarding the simulated game. For this purpose, the machine learning tool Orange, Version 3.36.2⁵ alongside two sentiment analysis algorithms, VADER and SentiArt, was employed (See Figure 1). VADER was used to classify students’ textual responses as positive, negative, or neutral, while SentiArt was used to identify emotions conveyed in the responses, such as anger, fear, disgust, happiness, sadness, or surprise, providing a comprehensive assessment of students’ perceptions of the simulated game intervention.

Figure no1: Data Mining Procedures in Organge 3.36.2



III. Result

Quantitative results

Table no3 shows the means, standard deviations, minimum and maximum values for each study variable by condition. Skewness and kurtosis indicated no violations of normality⁷ and no influential outlier data points were found.

Table no4 shows the correlation analyses for all variables in the study. It was found that there was a positive, statistically significant relationship between cognitive empathy and affective dissonance, with a coefficient of $r = .60$ ($p < .01$), and between cognitive empathy and affective resonance, with a coefficient of $r = .82$ ($p < .001$). This means that an increase in cognitive empathy was associated with an increase in affective dissonance and affective resonance scores. In addition, the analyses revealed that affective resonance was positively and significantly correlated with affective dissonance, as indicated by a coefficient of $r = .67$ ($p < .001$).

Table no3: Descriptive Statistics of Cognitive Empathy, Affective Resonance, and Affective Dissonance

	Cognitive Empathy	Affective Resonance	Affective Dissonance
Pretest			
<i>M</i>	45.35	48.52	48.80952
SD	4.58	4.24	5.55
Skewness	-.18	.59	.27
Kurtosis	2.83	2.85	1.80
Posttest			
<i>M</i>	48.14	48.62	49.38
SD	6.21	6.43	5.11
Skewness	-.13	-.60	-.27
Kurtosis	3.09	3.25	1.89

Note. *M* = mean, SD = standard deviation

Table no4: Correlation Matrix of Study Variables

		1	2	3
1	Cognitive empathy	1.00		
2	Affective resonance	.82*	1.00	
3	Affective dissonance	.60*	.67*	1.00

Note. * $p < .05$

A pairwise t-test was conducted to examine differences in cognitive empathy, affective resonance, and affective dissonance before and after a simulated game intervention. Results for cognitive empathy scores showed a statistically significant increase following the intervention ($M_{pretest} = 45.35$, $SD_{pretest} = 1.02$; $M_{posttest} = 48.35$, $SD_{posttest} = 1.41$; $t(19) = -3.41$, $p < .01$). This suggests that participants demonstrated higher levels of cognitive

empathy after the intervention, indicating an increased ability to understand the perspectives and emotions of others.

However, there was no significant change in affective resonance scores after the intervention ($M_{\text{pretest}} = 48.52$, $SD_{\text{pretest}} = 0.92$; $M_{\text{posttest}} = 48.62$, $SD_{\text{posttest}} = 1.40$; $t(20) = -0.07$, $p = 0.941$). Similarly, the change in affective dissonance scores was not significant ($M_{\text{pretest}} = 48.81$, $SD_{\text{pretest}} = 1.21$; $M_{\text{posttest}} = 49.38$, $SD_{\text{posttest}} = 1.12$; $t(20) = -0.445$, $p = .661$). Contrary to the initial interpretation, the increase in affective dissonance scores post-intervention suggests that participants experienced less emotional conflict in responding to others' emotions, not more, as indicated by the higher post-intervention scores.

In sum, the simulated game intervention had a positive effect on cognitive empathy but it did not significantly affect affective resonance or reduce affective dissonance, with the latter showing a nonsignificant increase, suggesting reduced emotional conflict.

Qualitative results

This section reports on the students' experiences using the simulated game in the classroom. In addition, the teacher's experience with the simulated game is reported, including her observations. This is complemented by an analysis of the sentiment findings, which are visually represented by a word cloud based on the students' responses.

Students' experience

Example 1. One student expressed a newfound understanding and empathy for refugees. The student noted, "I never really understood what it was like to live in a conflict zone, but the game made me realize how difficult and unpredictable life can be. It's not just the physical danger, but also the emotional toll of losing family members and the uncertainty of the future. (Student 09)

Students reported an increase in empathy, especially as they experienced different religions, cultures, and life situations. They noted the impact of individual choices and the role of chance and luck in life. Some students felt a connection to the game characters and experienced empathy that was different from their normal lives. For example, witnessing the deterioration of children's happiness and health after the death of a mother in the game elicited empathetic responses.

Example 2. One student expressed satisfaction with the unpredictability of the game, saying, "I loved how each game was a new adventure. One time I was born into a wealthy family in Japan, and another time I was a farmer in Kenya. It was fascinating to see how different life could be, and it made me feel more connected to people around the world. (Student 11)

Students liked the randomness of the game, which allowed for diverse experiences and increased empathy. They appreciated the opportunity to improve their financial status independently and to try new things in different countries. They also enjoyed the experience of being born in different countries.

Example 3. One student commented, "While I felt a connection to my character, I wish there was more personalization. I wanted to feel like I was really living their life, not just controlling a character on a screen." (Student 04)

While students felt a connection to the game characters, some expressed dissatisfaction with the level of personalization. They wanted a deeper, more personal connection with the characters.

Teacher's experience

The teacher's experience with the simulation game was influenced by the students' interest. One group of students showed interest and another group was less enthusiastic. The teacher noticed that the task of participating in the game was not graded, so some students did not engage or participate much in the class.

The teacher's personal experience with the game led to new insights. She was surprised to learn about the prevalence of depression in the world, which made her think seriously about mental health issues. She also noticed the socioeconomic differences between public and private school students in Korea. The teacher's own simulation experience, mostly in Southeast Asia, reflected her real-life philosophy of avoiding risk. When she played with a colleague, their choices in the game mirrored their real-life choices, leading to similar life outcomes in the simulation.

The teacher observed that her students were new to the serious game concept and found it challenging. They were not interested in the "reflection" component of the lesson, and the cultural and social issues presented in the game were difficult for them to understand. The teacher felt that middle school students have too little information about world issues, which was a hurdle for them in the game.

However, the teacher also observed positive effects of the game. For example, it broadened the students' worldview and allowed them to experience different cultures, which fostered empathy for people in other regions. The teacher shared several experiences that brought tears to the eyes of the players, such as when a virtual father became unemployed or when a student experienced 50-60 years of drug addiction in the simulation.

The correlation between cognitive empathy and affective dissonance, as well as cognitive empathy and affective resonance, highlights the game's relationship to promoting understanding and engagement with others' emotions and perspectives. In addition, the statistically significant increase in cognitive empathy scores after the intervention underscores the game's impact in increasing students' ability to meaningfully identify and understand the emotions of others.

However, this study also found no significant changes in affective resonance and affective dissonance scores following the intervention. This finding is consistent with the findings of Kral et al.⁹ and Craig et al.⁴, who also reported no significant effects. These findings suggest that while the game was effective in improving cognitive aspects of empathy, it may not have had a significant impact on reducing emotional conflict in responding to others' emotions. This variation in findings highlights the complexity of the empathy construct.

Qualitative feedback from students and the classroom teacher complemented the findings, revealing a generally positive view of the simulated game as an educational tool. Students' responses to their gameplay experiences, along with the teacher's observations, provide valuable insights into the game's strengths and areas for potential improvement. For example, the teacher noted that some students did not take the reflection assignment seriously because it was not graded. Overall, the feedback suggests that while the game successfully engaged students and provided an immersive learning experience, there are opportunities to improve both the game and the intervention to more effectively develop the emotional and affective aspects of empathy.

In conclusion, this study contributes to the growing body of evidence supporting the use of serious games as effective tools for enhancing cognitive empathy in middle school students. However, the findings also highlight the need for additional research to determine how simulated games can more effectively address the affective components of empathy. Future research should explore, for example, the incorporation of social interaction features to improve the empathetic outcomes of serious game-based learning experiences.

This study has two limitations. First, the classroom intervention was limited to the use of a single simulated game. This one tool may have limited the scope of the investigation, as the inclusion of a broader range of simulated games, particularly those classified as serious games designed to address adversity, could potentially improve outcomes. Therefore, it is important for future research to explore the use of different simulated games in different demographic groups, including younger cohorts such as elementary school children, to determine their effectiveness in promoting empathy and other experiences for participants.

The second limitation relates to the number of participants in the study. The limited number of participants undermines the ability to generalize the study's findings to a broader adolescent population. To overcome this limitation, future research should consider using a larger sample size. Such an approach would increase the robustness of the evidence supporting the use of simulated gaming as an effective tool for increasing empathy in students.

V. Conclusion

In conclusion, this research highlights the significant potential of simulated games as effective tools for enhancing global empathy and fostering an interest in exploring diverse cultures among middle school students. The empirical evidence suggests that incorporating these simulated gaming platforms into educational frameworks could positively affect students' empathy levels. This integration supports educational goals focused on developing socio-emotional skills and promotes a more empathetic and culturally aware student body.

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