Exploring Insights of DotA Gamers in Learning Mathematics: A Qualitative Study

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Abstract

The World Health Organization (WHO) has formally recognized Gaming Disorder, characterized by excessive and compulsive gaming akin to addiction. This phenomenon has caught the attention of many Filipino students and professionals who are deeply engaged in the popular online game, Defense of the Ancients (DotA). Many literature and research studies underscore the adverse consequences associated with such addictive gaming behavior, supported by robust empirical evidence. Addressing this issue, the present study employs a single descriptive case study approach to delve into the insights of students who are avid DotA gamers, particularly in the context of their mathematical learning experiences. Grounded in the Gestalt theory, which emphasizes the holistic perception and organization of experiences, this study sheds light on the intricate interplay between gaming and mathematics education. Through purposive selection, five participants willingly contributed to this study, each fulfilling predefined criteria. Thematic analysis of the data revealed prominent themes centered around the potential enhancement of cognitive skills attributed to gaming and the multifaceted factors influencing the integration of gaming elements into mathematics education. In light of these findings, it is recommended that educators explore interactive and informative game-based approaches to Mathematics teaching.

Keywords: Online Game, DotA, Case Study, Mathematics performance

1. Introduction

The rapid strides made in the realm of Science and Technology have profoundly reshaped our way of life and the functioning of our society. In contemporary times, there has been a noticeable shift in the student population, with an increasing reliance on gadgets that have become integral components of their daily existence. Furthermore, their adeptness in utilizing advanced technology surpasses that of preceding generations. Prensky (2001) emphasized this cohort as Digital Natives, individuals born during the era of digital dominance. He expounded that they are well-versed in diverse digital technologies, encompassing activities such as messaging on platforms like messenger, engaging in video calls via Skype, consuming video content, crafting blogs, creating vlogs, exploring the internet, and participating in online gaming.

In the contemporary era, the impact of online video gaming, particularly the game DotA, extends beyond just teenagers and resonates across all age demographics. DotA, also known as Defense of the Ancient, stands as a multiplayer online arena game where two teams of five players each engage in combat. As the gameplay commences, participants accumulate valuable in-game currency, items, and experience points for their chosen characters while clashing with opponents' avatars. According to Rayo

(2012), the advent of DotA in the Philippines has sparked a significant attachment among millions of Filipinos. Fueled by human curiosity, a multitude of individuals have been enticed and captivated by the allure of this strategic game, leading to a notable sense of obsession.

According to Nasution et al. (2015), video games, particularly the act of playing DotA, have been identified as a potential contributor to the academic underperformance and lack of proper manners observed among students in both public and private educational institutions. A significant number of learners allocate more of their time to engaging in DotA and similar video games rather than focusing on their studies. The allure of Massively Multiplayer Online Role-Playing Games (MMORPGs) such as DotA has been linked to addictive tendencies, attributed to their immersive and somewhat enigmatic nature (Sanchez-Carbonell et al., 2008). In these games, players are provided a platform to consistently interact with other players through the avatars they control, facilitating not only the construction of online identities but also detachment from real-world personas (Talarn & Carbonelle, 2009). In certain instances, MMORPGs like DotA have been associated with distinctly adverse consequences. Smyth (2007) asserted that individuals who excessively engage in MMORPGs, including DotA, tend to experience deteriorating health, compromised sleep quality, heightened challenges in face-to-face social interactions, and a decline in academic performance. Furthermore, the World Health Organization (2018) brought attention to gaming disorder, which is defined in the draft 11th Revision of the International Classification of Diseases (ICD-11) as a recognizable pattern of gaming behavior, marked by impaired control over gaming, a growing prioritization of gaming over other pursuits to the extent that it supersedes other interests and daily activities, and the persistent continuation or escalation of gaming despite the emergence of negative consequences. However, Craton (2011) emphasized that the impact of video games extends beyond mere entertainment and holds considerable potential in the realm of education. Games, according to Craton, possess a robust influence on the learning process and should not be dismissed as mere frivolities.

On a contrasting note, Demirbilek and Tamer (2010) underscored the potential of making mathematics learning more meaningful through an enjoyable gaming context. Such an approach could aid learners in cultivating a heightened focus and deeper engagement with the subject. Clearly, games hold the capacity to enhance students' mathematical prowess, particularly in strategic and reasoning domains (Bottino et al., 2007). Additionally, Abramovich (2010) emphasized the efficacy of games in enhancing problem-solving and algebraic skills, thereby elevating students' mathematical achievements. Within the virtual realms of these games, participants are compelled to make critical decisions, discern trustworthy sources, and devise optimal strategies for group leadership. Moreover, participants in online video games are swiftly acquiring social skills and prosocial behaviors that have tangible applications in their interactions within peer groups and family dynamics in the real world (Gentile et al., 2009). Furthermore, Yong (2017) asserted that the integration of video games into mathematics education could foster learners' persistence in tackling intricate tasks demanding complex problem-solving and critical thinking skills. This underscores the considerable role of technology in reshaping the ways in which young individuals engage, interact, and acquire knowledge (Helsper and Eynon, 2010).

However, there are instances where educational institutions exhibit a limited utilization of computers for instructional purposes. For instance, traditional modes of teaching like lectures, chalk-

and-talk sessions, paper-and-pencil exercises, and rote practice continue to dominate the mathematics classroom (Bragg, 2003). These conventional methods often result in students harboring negative attitudes and lack of motivation toward mathematics. Consequently, they may lack confidence in tackling multifaceted and intricate mathematical challenges (Awanta, 2009). In line with this, Anderson and Dill (2000) emphasized that persistent engagement in video games could potentially lead to diminished academic performance among learners.

In spite of the considerable volume of research endeavors aimed at scrutinizing the correlation between video games and the scholastic accomplishments of students, a substantial proportion of these investigations have predominantly been carried out within Western countries (Nasution, 2015). In this context, the present study aspires to offer insights that hold distinct relevance for local readers. The researcher envisions that the outcomes of this study will hold particular significance in uncovering the manners in which students derive learning experiences from their engagement with DotA, and the subsequent impact on the evolution of mathematics pedagogy. Moreover, the essence of this qualitative inquiry revolves around delving into the perspectives of DotA enthusiasts concerning their journey of learning mathematics. This exploration is concentrated within a state university located in the province of Leyte, Philippines. The intention is to paint a comprehensive picture that accurately captures the insights, beliefs, and experiences of these individuals as they navigate the intersection between their passion for DotA and their engagement with the domain of mathematics.

1.1. Statement of the Problem

This study determined the insights of students who are DotA gamers in learning Mathematics. Specifically, this sought to answer the following questions.
1. What are the insights of students who are gamers in *Defense of the Ancient* (DotA)?
2. How do these DotA gamers perceive their way of playing in relation to learning Mathematics?

1.2. Theoretical Framework

This research draws its theoretical framework and guidance from the Gestalt theory, which is particularly relevant in understanding the insights of Dota gamers in their mathematical learning experiences. The Gestalt theory places significant emphasis on human learning, especially in the domains of perception and problem-solving. According to this theory, individuals learn through their personal life experiences and cognitive awareness. Effective instruction is achieved when it aligns with learners' real-life practices. Moreover, the theory asserts that the human brain's ability to formulate meaningful concepts is strongly influenced by the accumulation of life experiences. When the human brain encounters specific situations, it spontaneously constructs comprehensive and meaningful ideas. This process involves the integration and assimilation of diverse learning encounters to construct a coherent and comprehensive conceptual framework (Wertheimer, 1938).

The core principles of the Gestalt theory have direct relevance to the cognitive aspects of higher-order thinking skills, which are vital in the context of Dota gamers' engagement with mathematics. Within this context, learners leverage advanced problem-solving and critical thinking abilities. They analyze presented mathematical concepts and assess the underlying connections between different ideas to create a holistic and meaningful understanding. This process enables learners to identify distinct

relationships among the concepts and insights presented, fostering a deeper grasp of mathematical concepts (Ehrenfels, 1937).

2. Methodology

2.1. Research Design

A single descriptive case study design was employed to ascertain the insights of students who are actively involved in playing DotA (Defense of the Ancients) in relation to their insights concerning the learning of mathematics. According to Omair (2015), a descriptive single case study design is characterized by its focus on delineating the fundamental attributes inherent in the representative sample utilized within the study. In this specific context, this design seeks to provide a comprehensive exploration of the viewpoints and attitudes held by students who identify as DotA gamers, offering a nuanced understanding of how their participation in the game intersects with their mathematical learning journey.

2.2. Research Participants and Locale

In this interpretive research study, aimed at delving into participants' insights, a purposive sampling strategy was meticulously employed to ensure participant selection (Denzin & Lincoln, 2000). The process involved the deliberate identification of five participants based on their availability, eligibility, willingness to partake in interviews, and their duration of engagement with DotA. As stipulated by Gerring (2007), case study research often entails a case count of fewer than 12, or even a single case.

These chosen participants were drawn from the pool of education students within a state university situated in the province of Leyte, Philippines. The interviews ranged in duration from five (5) to twenty (20) minutes. Additionally, the demographic makeup of the participant group aligns with the findings of Burgess et al. (2012) and Khadra (2013). As Burgess et al. (2012) indicated, around 81% of online video game players fall within the age range of 18 to 21 years old. Correspondingly, Khadra (2013) highlighted a preponderance of male students compared to female students engaged in video gaming.

2.3. Data Collection

Throughout the interview phase, meticulous notes were taken in accordance with participants' responses, serving as a foundation for meaningful and relevant follow-up inquiries, intended to deepen understanding and clarify insights (Rubin & Rubin, 2005). These interviews were also audio-recorded to facilitate the transcription process and ensure the comprehensive capture of participants' statements. The audio recordings proved sufficient as they aimed to capture participants' viewpoints and perceptions. Video recordings were not employed, primarily because the research did not encompass any experimental evaluation of students' gaming behavior. Classroom observations were omitted from the study due to its focused scope, which concentrated solely on exploring the perspectives of DotA gamers and their perceived connections between their gaming experiences and the learning of Mathematics.

2.4. Data Analysis

The research methodology employed in this study revolved around thematic data analysis, as elucidated by Braun and Clarke in 2013. This analytical approach was meticulously applied to the dataset amassed during the research endeavor. By embracing this method, the study was equipped to delve deeply into

the intricacies of the subject under investigation. Through a systematic process of research, the study adhered to the following sequence of actions: Firstly, the collected data underwent transcription, transforming it into written form for further examination. This served as the foundational step in rendering the raw data more accessible for subsequent analysis. Next, a comprehensive reading of the data was conducted to establish familiarity and an initial understanding of its contents. Following this, a coding process ensued, systematically categorizing and labeling data segments to facilitate organization and analysis. Within the coded data, patterns and recurring themes were discerned, fostering a cohesive framework for understanding the participants' insights. These emergent themes were subjected to rigorous review, ensuring their accuracy and consistency. Upon validation, each theme was meticulously defined and aptly named, serving to encapsulate its essence. Finally, the culmination of this methodical journey involved arriving at conclusive insights and interpretations drawn from the comprehensive analysis of the data.

2.5. Ethical Considerations

The researchers adhered to established protocols concerning ethical considerations encompassing human rights, legal compliance, conflict of interest, safety, and health standards. Permission for one-on-one interviews was diligently obtained from the five participants, taking into account their availability and willingness to engage in the interview process. Additionally, the researchers demonstrated due credit to all the authors whose work contributed to this study. Participants were well-informed that their responses and identities would be treated as confidential, safeguarding their privacy and ensuring the integrity of the research.

3. Results and Discussion

Utilizing the thematic data analysis methodology elucidated by Braun and Clark (2013), the ensuing key themes have been meticulously formulated and comprehensively interpreted within this study.

Theme 1. Potential Enhancement of Cognitive Skills Attributed to Gaming

Engaging in video games has the potential to enhance crucial skills that hold significance in the realm of mathematical learning. These skills encompass problem-solving, spatial navigation, teamwork, multi-tasking, and concentration abilities (Cherenkova and Alexandrov, 2013). Correspondingly, in the context of this study, a substantial number of participants attested to the presence of these skill enhancements through gaming, recognizing their applicability to the learning of Mathematics.

Within the domain of playing DotA, participants exhibit an active disposition toward problem-solving. They are afforded the liberty to explore various avenues within the game (Gee, 2007). While the problem-solving challenges within the game might not seamlessly translate into real-world scenarios, there are certain instances where lessons gleaned from computer video games can find relevance (Beck and Wade, 2006).

Participant 2: *"...strategies, similar to those employed in games to secure victory, such as planning our approach and actions, much like the strategic thinking involved in both Mathematics and DotA...a strategy to address and solve problems."*

Participant 3*: "In DotA, there exists a significance attributed to acquiring items for the hero... prior to obtaining these items, you must accumulate in-game currency or gold in DotA, which closely resembles... hence, there's a connection to Mathematics as you engage in calculations, adding up the costs of items, all the while managing time constraints..."*

Participant 5*: "...I draw parallels between DotA and Math, utilizing the strategic approach I employ in the game to tackle the presented problem."*

When engrossed in DotA, video gamers have the opportunity to develop land navigation proficiencies that encompass the usage of tools like compasses, maps, global positioning systems, and an inherent sense of direction. Acquiring these land navigation skills necessitates a robust spatial aptitude (Self and Golledge, 2000). DotA, known as Defense of the Ancients, operates in a transparent manner, necessitating players to envision their adversaries' strategies and objectives (Beck and Wade, 2006). Engagement in video games holds the potential to enhance one's spatial acumen (Mitchell and Savill-Smith, 2004). As highlighted by Paul (2013), individuals who excel in spatial skills are more likely to demonstrate proficiency in action-oriented or simulation-based games.

Participant 1*: "...calculating, like when your hero moves vertically, you're considering angles to determine where to launch your attack, strategically releasing your skills while simultaneously assessing the map...it's a mental process of achieving accurate estimations."*

Participant 3*: "In the realm of DotA, heroes possess distinct abilities...the ability to time when to cast, when to engage in attacks, and an understanding of the reach of your skills. It's essential to comprehend the extent of my avatar's skill range, allowing me to gauge the effectiveness of its abilities during battles."*

Participant 5*: "Prior to engaging enemies, I must grasp their positions via the map, and once I decide to strike, timing becomes crucial... Simultaneously, I envision potential outcomes, considering whether to initiate an attack or withhold."*

DotA gamers are actively honing their teamwork abilities, as effective collaboration among all team members is essential for triumph, involving both the provision and receipt of assistance. This video game's framework allows players to seek extra life, resources, or aid from their peers. This phenomenon helps elucidate the appeal of multiplayer games to younger players (Gee, 2007). Within DotA, no single character is flawless; each possesses a unique blend of strengths and vulnerabilities. Moreover, a player's experience remains subjective and distinct, contingent upon their interactions with the virtual environment and fellow players (Feinstein et al., 2002). It's noteworthy that children derive more enjoyment from engaging in computer games alongside friends rather than solitary play (Shahid et al., 2014). Consequently, players are compelled to cultivate their interpersonal proficiencies, as no character can thrive in isolation without effective cooperation with others (Squire, 2003; Feinstein et al., 2002). Furthermore, within DotA, each player assumes a distinct role within a guild, be it a tank, support, healer, or damage-dealer, each role being indispensable to successfully undertake quests.

Participant 1*: "In a broader sense, participating in DotA is enjoyable, offering not only the opportunity to enjoy gameplay with friends, but also the chance to refine communication abilities by orchestrating team actions, such as directing teammates to advance or withdraw."*

Participant 3: *"While engaged in gameplay, it's important for me to take the initiative in strategizing how to overcome adversaries. Additionally, there are instances where effective communication with my teammates becomes essential for securing victory."*

Participant 4: *"To my perspective, teamwork is a fundamental aspect of DotA. However, within a team, there might be instances where one member becomes a liability, causing complications and challenges during gameplay."*

Participant 5: *"Engaging in DotA has significantly elevated my teamwork capabilities. As an illustration, I consistently align myself with my preferred team due to my familiarity with its members. This strategic choice enhances our prospects of achieving victory in the game."*

As outlined by Zelinski and Reyes (2009), video games facilitate the acquisition of two distinct types of multitasking skills: time-pressured multitasking and multitasking involving memory load. In the context of time-pressured multitasking, gameplay actions persist even as players are engaged in decision-making processes. On the other hand, multitasking with memory load entails managing multiple in-game characters concurrently while striving to attain specific objectives (Zelinski and Reyes, 2009). Multitasking stands as a prevalent trait among digital natives.

Participant 1: *"Playing DotA helps me think better and learn when and how to use my hero's items and skills. It's like a workout for my brain that makes it function better."*

Participant 2: *"DotA isn't just a regular game; it's like a mental challenge that makes us think hard about what moves to make. We have to come up with strategies, analyze situations, and make smart decisions while playing DotA."*

Participant 3: *"Imagine we're in the middle of the game. While we're there, we can pick up gold coins. Once we gather a good amount of coins, we can use them to buy stuff and make our skills stronger. And while we're doing all this, let's set a goal: defeat enemies to earn even more gold coins."*

Participant 4: *"When we talk about Dota, it's not just a simple game. It actually needs our brain power. If we don't think and get stressed out, just like in Math, we won't be able to play well or do things right."*

While engrossed in DotA, players encounter a multitude of information conveyed through various means, yet they develop the skill to effectively center their focus on specific aspects. Moreover, DotA gameplay often demands that players simultaneously manage multiple elements within intricate visual settings, akin to multitasking involving memory load (Latham et al., 2013). However, it's important to avoid assuming that students adept at multitasking lack the ability to concentrate (Brown, 2000). Evidently, prior research has frequently highlighted improvements in visuospatial attention observed among individuals engaged in video game play (Latham et al., 2013).

Participant 1: *"Imagine if two of us are playing and we control two heroes with disabling skills. If we make an opponent unable to use their skills because of our abilities, we have to be careful. We need to decide when to use our 'stun' ability so it's effective. The 'stun' only lasts for 3 seconds, so we need to pay attention and time it right."*

Participant 4: *"Let's say my hero is in a fight. I need to be aware of how much mana I have left. I should carefully choose which skills to use while also keeping an eye on how much mana my hero has."*

Theme 2. Factors Influencing the Integration of Gaming Elements into Mathematics Education

The realm of computer games presents an incredible avenue for enhancing mathematical learning. Even students who typically show little interest in Mathematics become engrossed in computer games that entail intricate calculations and problem-solving challenges (Chang, 2009). When it comes to incorporating games into mathematics education, this study outlines two key factors. Firstly, the game should possess an edutainment quality. Edutainment refers to forms of entertainment like games, movies, or shows designed to be educational. Engaging with computer video games can temporarily shift the focus away from traditional academic material, offering some individuals a mental boost that translates into improved academic performance for others (Khadra et al., 2013).

Participant 3*: "When a lesson is taught, it's really helpful to have a game involved. This way, we won't feel stressed, especially if Math isn't our strong point. So, when there's a class discussion, having a game connected to the topic makes us more engaged and energetic."*

Participant 4*: "I think adding games to Math class is a good idea. Math can sometimes be dull with all the lectures, discussions, and written stuff. Personally, I find it more interesting when there's a game during class discussions, especially if I can connect with it."*

Another crucial point is the teacher's skill and expertise, which plays a vital role in ensuring effective Math learning for students. In today's rapidly evolving world, students are acquiring technological skills beyond the classroom, as these skills become part of their daily lives. However, a significant portion of teachers may not be keeping pace with this external learning and could hold the belief that education solely transpires within school premises (Yong, 2017). Furthermore, Yong asserts that playing computer games involves experiential learning, where knowledge is gained through hands-on experience. This highlights the need for teachers to adapt their approach to cater to these digital-native learners, who thrive in technology-rich environments.

Participant 2*: "I hope my Math teacher doesn't just talk all the time during class."*

Participant 1*: "Just add some games or activities...anything to make the class more interesting and not boring."*

Participant 5*: "I think teachers should have fun while teaching. When they're enjoying it, we'll enjoy it too. But sometimes teachers use the same old method, just talking. They could try adding games or even using cool math apps to help us learn better."*

4. Conclusion and Recommendation

Undoubtedly, participants find that their abilities in problem-solving, spatial orientation, teamwork, multitasking, and concentration flourish as they engage with the DotA game. They are also convinced that these skills, nurtured through gaming, hold potential applicability in the context of learning Mathematics. This alignment with Gestalt theory suggests that learning is greatly influenced by personal experiences and insights, forming a meaningful and interconnected understanding.

Based on Gestalt principles, the study delves into essential considerations for seamlessly integrating games into the Mathematics educational landscape. Beyond pure entertainment, games should be designed to be both informative and engaging, in resonance with the Gestalt perspective that meaningful

learning stems from relevance to one's experiential reality. Furthermore, the teacher's competence is paramount. A skilled educator can effectively bridge the gap between learners and their digital-native tendencies, aligning with Gestalt's emphasis on congruence between the individual and their environment.

In light of these findings, it is recommended that educators explore interactive and informative game-based approaches to Mathematics teaching. By embracing the principles of Gestalt theory, teachers can harness the potential of digital natives' inherent affinity for technology-enhanced learning experiences. Moreover, professional development opportunities should be extended to teachers, enabling them to harness technological tools effectively and establish a harmonious learning environment that caters to the unique needs of the modern learner.

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