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I chose these four papers because I've long been curious about a question: why can a game be so captivating that it's hard to stop playing? It's not uncommon for people to stay up late, delay meals, and even forget assignments, just to complete one more stage of the game. This curiosity prompted me to explore various studies that explored this phenomenon from a scientific perspective. In the process, I discovered many fascinating insights into how the world of gaming interacts with the human mind, emotions, and behavior, ultimately leading to such a strong sense of connection.

PAPER 1:

Why We Can't Stop: The Impact Of Rewarding Elements In Videogames On Adolescents' Problematic Gaming Behavior

Davide Pirrone, Regina J. J. M. Van Den Eijnden & Margot Peeter

Research by Pirrone et al (2024), van den Eijnden, and Peeters (2024) explored the relationship between reward elements in video games and problematic gaming behavior in adolescents, and how individual vulnerabilities strengthen this relationship. This study sought to answer two main questions: are certain elements in games associated with problematic gaming behavior, and whether individual vulnerabilities such as ADHD or social difficulties strengthen this relationship. As the researchers wrote, "Are certain rewarding gaming elements associated with problematic game play? Do individual vulnerabilities (attentional disorder, impulsivity, hyperactivity, social competence) amplify the association between certain rewarding game features and problematic game play?" (Pirrone et al., 2024, p. 383).

The motivation for this research arose from growing concerns about gaming addiction among adolescents. Gaming has become a primary activity for adolescents in many countries. "Game playing has become one of the main leisure activities of adolescents in many developed countries and is prevalent across many cultures" (Pirrone et al., 2024, p. 379). However, the problem is, "Unfortunately, like many other highly rewarding activities, a minority of gamers pursue the activity in such an excessive and uncontrolled manner that the behavior becomes problematic or addictive" (Pirrone et al., 2024, p. 379). What's interesting is the focus on how the structure of the game itself can be a trigger, especially since the gaming industry is designed to maximize profits by utilizing manipulative reward systems.

This study uses the Differential Susceptibility to Media Effects Model (DSMM) by Valkenburg and Peter (2013) as a theoretical framework. This model explains that not everyone reacts the same way to media; some are more susceptible depending on their dispositional,

developmental, and social factors. In this context, adolescents with ADHD symptoms or social difficulties are thought to be more susceptible to reward mechanisms because they are attracted to systems that provide instant gratification and clear structure.

In terms of methods, the researchers used data from the Digital Youth Project, which involved two cohorts of adolescents in the Netherlands: Cohort 1 with 2,708 students (53.9% male, mean age 13.9 years) and Cohort 2 with 1,616 students (54.2% male, mean age 14.7 years) (Pirrone et al., 2024, p. 384). Respondents were asked to name the games they played most frequently in the past three months, and then four researchers coded each game based on four types of rewards: random rewards such as loot boxes, contingency rewards such as daily login bonuses, social rewards such as multiplayer collaboration, and meta-achievements such as trophies (Pirrone et al., 2024, p. 385).

The main findings showed that three types of rewards (random, contingency, and social rewards) were significantly associated with problematic gaming behavior, while meta-achievements were not. More interesting are the findings regarding moderation: the association between reward contingencies and problematic gaming was stronger in adolescents with ADHD symptoms, while the association between social rewards and problematic gaming was stronger in adolescents with low social competence. "Results indicated that the association between reward contingencies and problematic gaming behavior was stronger for adolescents with attention-deficit/hyperactivity disorder symptoms, while the association between social rewards and problematic gaming was stronger for adolescents with social problems" (Pirrone et al., 2024, Abstract, p. 379). This means that not all adolescents react equally to game design.

This study concludes that some reward elements in games contribute to problematic gaming behavior, but this risk is not uniform, with adolescents with ADHD symptoms or social difficulties being more vulnerable. Therefore, prevention approaches need to be more targeted and personalized. "These insights can contribute to a more tailored prevention and treatment approach aimed at problematic gaming among adolescents" (Pirrone et al., 2024, Abstract, p. 379). Researchers even suggest that "Gaming companies could introduce features in a game to assist those who may be prone to addictive tendencies from losing track of time while playing" (Pirrone et al., 2024, p. 393).

Methodologically, this study is quite strong, using two cohorts for replication and not relying on respondents' recall. I appreciate its focus on mechanisms, not simply blaming the game or the teen, but rather demonstrating the interaction between game design and individual vulnerability. The weakness is that the data is cross-sectional, so it cannot definitively draw causal conclusions. For me, this study is a step forward in understanding digital technology from a psychological and ethical perspective. For informatics students like me, it provides a warning that we can create technologies that are detrimental to mental health, but also an opportunity to design systems that encourage learning and personal growth, rather than simply maximizing screen time.

PAPER 2:

Exploring The Relationship Between Stress And Excessive Gaming: The Role Of Game Efficacy

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Research by Lee et al (2025) explored the psychological mechanisms behind the relationship between stress and excessive gaming in adolescents, introducing game efficacy as an important moderating factor. This study provides insight into why some adolescents can use gaming as a stress management strategy without becoming addicted, while others fall into excessive usage patterns. The researchers sought to answer three questions: whether academic stress and peer stress are associated with excessive gaming, whether game efficacy is associated with excessive gaming, and whether the interaction between the two strengthens this relationship. As stated, "Hypothesis 1: Academic and peer stress are positively and significantly related to excessive gaming, respectively. Hypothesis 2: Game efficacy is positively and significantly related to excessive gaming. Hypothesis 3: The interaction between each stress and game efficacy is positively and significantly related to excessive gaming" (Lee et al., 2024, p. 4).

The motivation for this research arose from growing concerns about the negative impacts of excessive gaming, especially after the WHO classified Gaming Disorder as a mental health disorder. However, not all adolescents experiencing stress develop excessive gaming behavior, so researchers want to understand the underlying mechanisms. "With the dramatic increase in video game playing, however, excessive gaming has emerged as a major public health concern... Notably, professional organizations like the World Health Organization (WHO) have issued warnings regarding the potential harm of excessive gaming to children and adolescents, even classifying it as a 'Gaming Disorder'" (Lee et al., 2024, p. 2). Of particular interest is the focus on how individuals' beliefs about their gaming abilities are a key factor in understanding excessive gaming behavior.

This study utilizes two main theoretical frameworks. The first is Lazarus and Folkman's (1984) transactional theory of stress and coping, which states that stress is a negative experience perceived as threatening, and individuals choose the coping strategies they deem most effective. Second, Bandura's (1977) self-efficacy theory is applied to the gaming context as game efficacy, defined as "an individual's belief in their ability to succeed at playing a video game" (Lee et al., 2024, p. 3). Game efficacy is an important factor in understanding why some adolescents are more susceptible to excessive gaming when faced with stress.

In terms of methodology, the data comes from the Game User Panel (GUP) conducted by the Korea Creative Content Agency, involving 801 Korean adolescents in grades 4, 7, and 10 from three regions: Seoul, Incheon, and Gyeonggi-do. Data were collected in five waves from 2014 to 2018, providing a longitudinal perspective on changes in gaming behavior over time. The main variables measured included excessive gaming with 20 Likert-scale questions, academic stress with 4 items, peer stress with 3 items, and game efficacy with 9 items. The analysis was conducted using cross-lagged dynamic panel models to understand the longitudinal relationships between variables, controlling for variables such as self-control, self-esteem, peer support, and parental supervision.

The results revealed interesting findings. Academic stress was significantly associated with excessive gaming ($\beta = .100$, $p < .001$), but peer stress showed no significant association. Game efficacy had a very strong positive effect on excessive gaming ($\beta = .395$, $p < .001$), indicating that adolescents who feel competent in gaming tend to play more. Most interesting was the moderation finding, as explained: "The interaction between academic stress and gaming efficacy was significantly related to more excessive gaming ($\beta = .119$, SE = .051, $p < .05$) in Model 3, suggesting that gaming efficacy conditions the relationship between academic stress and excessive gaming" (Lee et al., 2024, p. 7). This means that the effect of academic stress on excessive gaming is amplified by high game efficacy. Teenagers who feel competent at gaming tend to play more when experiencing academic stress, because gaming becomes a place where they feel successful and capable.

This study concluded that excessive gaming is triggered more by academic stress than social stress, and that game efficacy plays a significant moderating role. Games serve not only as entertainment but also as a maladaptive coping strategy to avoid stress, especially when individuals perceive themselves as competent within the game world. As the researchers explain, "Video games become a favorable and attractive coping strategy for adolescents who are under academic stress and exposed to virtual environments, albeit maladaptive in nature" (Lee et al., 2024, p. 9). Games become an attractive escape for stressed adolescents because they provide a sense of competence and accomplishment they may not experience in their academic lives.

Methodologically, this study has significant strengths because it uses a longitudinal approach with five waves of data, allowing for an understanding of how relationships between variables develop over time. The use of cross-lagged dynamic panel models also allows researchers to better understand the direction of relationships and the effects of time. I appreciate the focus on game efficacy as a rarely researched psychological factor, providing a deeper understanding of why some adolescents are more vulnerable. However, this study also has limitations. First, the study didn't consider different game types, even though MMORPGs, competitive games, or narrative games may have different effects. Second, the data is based on self-reports, which are susceptible to social desirability bias.

For me, this research is highly relevant in the stressful context of higher education, such as in Korea and many other Asian countries. Games are not just entertainment, but also provide an alternative space for building a sense of competence and autonomy that is often lacking in the real world of academic pressure. For informatics students like me, this is both a warning and an opportunity: we can design systems that provide positive stimuli and a sense of accomplishment without reinforcing dependency, for example, with features that encourage breaks or offline activities.

Comparison with the First Paper: When compared to the research by Pirrone et al. (2024), there are significant differences in focus. Pirrone's paper focuses on how game design itself, specifically reward elements like loot boxes, daily login bonuses, and social rewards, contribute to problematic gaming, and how individual vulnerabilities like ADHD and social difficulties strengthen this relationship. Meanwhile, Lee's paper focuses on external factors such as academic stress and internal psychological factors such as game efficacy as triggers for excessive gaming. Pirrone looks at it from the perspective of "what's in games that makes us addicted," while Lee looks at it from the perspective of "why we seek escape in games and

when that escape becomes excessive." Pirrone emphasizes the interaction between technological design and biological or social vulnerabilities, while Lee emphasizes the interaction between environmental stressors and perceived self-competence. Both studies suggest that not all adolescents react equally to gaming, but with different focuses: Pirrone's on who is vulnerable based on innate psychosocial characteristics, Lee's on how stressful contexts and self-efficacy influence gaming patterns. Methodologically, Pirrone used a cross-sectional approach with two cohorts, while Lee used a more robust, five-wave longitudinal approach to examine changes over time. Both make important contributions: Pirrone's on more ethical game design, Lee's on stress-management interventions and real-world competence enhancement.

PAPER 3:

What makes video gaming productive or addictive? Differential effect of self-determined motivation and need frustration on adolescents' video gaming

Hoon S. Choi a a,* , Eui Jun Jeong b , Dan J. Kim

Research by Choi et al (2025) offers a different theoretical approach than the previous two papers by distinguishing between productive game use (adaptive game use) and game addiction through the lens of Self-Determination Theory (SDT). This study aims to clarify the controversy over who is responsible for game addiction—whether the game design itself or individual personal factors. As the researchers state, "This study aims to clarify an ongoing controversy among stakeholders in the video game domain by examining the differential effects of self-determined motivation and need frustration on adaptive game use and game addiction" (Choi et al., 2025, p. 1). This study attempts to answer whether self-determined motivation is more related to productive game use, whether need frustration is more related to addiction, and whether academic stress amplifies the transition from productive use to addiction.

The motivation for this research arises from ongoing social controversies. On the one hand, the government tends to blame the games themselves, while the game industry argues that addiction is more caused by personal factors. "Governments often attribute addiction to video games themselves... while the video game industry contends that game addiction is more likely to arise from personal factors" (Choi et al., 2025, p. 1). Interestingly, this research shows that productive game use and addiction are not mutually exclusive, but rather there is continuity between the two. "Adaptive game use precedes video game addiction. Individuals who become addicted to video gaming were once casual users enjoying it as a leisure activity" (Choi et al., 2025, p. 4). This means that someone who becomes addicted to gaming was once a casual player who enjoyed games for entertainment, and certain factors caused them to transition to excessive usage patterns. Expanded access to games is also an important factor, as stated: "The proliferation of gaming platforms—computers, consoles, and smartphones—has facilitated widespread access to video games, boosting the popularity of video gaming" (Choi et al., 2025, p. 1).

This study uses Deci and Ryan's (2000) Self-Determination Theory (SDT) as a theoretical framework. SDT states that humans have three basic needs: competence, autonomy, and relatedness. "Self-determination theory asserts that individuals have three innate needs for

autonomy, competence, and relatedness..." (Choi et al., 2025, p. 2). Motivation is divided into intrinsic (from within oneself) and extrinsic (from outside), where "Intrinsic motivation pertains to actions taken for fundamental interest and enjoyment, often affecting behaviors more substantially than extrinsic motivation" (Choi et al., 2025, p. 2). In the context of gaming, factors that trigger self-determined motivation include game efficacy (self-confidence in playing games), game social norms (social norms among friends), and game leadership (leadership in games). Meanwhile, need frustration arises when basic needs are not met in the real world, for example due to academic stress, defined as "the unpleasant mental state caused by unmet needs in achieving satisfactory academic performance" (Choi et al., 2025, p. 3), stress from friendships, or parental intrusion.

In terms of methodology, the data came from the Korean Game Panel Study (KGPS), which involved 778 Korean adolescents aged 10 to 16. The analysis used consistent Partial Least Squares Structural Equation Modeling (PLS-SEM) to compare the relationships between variables with adaptive game use and game addiction. The independent variables included self-determined motivation (game efficacy, game social norms, game leadership) and need frustration (academic stress, stress from friendships, parental intrusion), while the dependent variables were adaptive game use and game addiction. This methodological approach allowed researchers to directly compare which factors had a stronger influence on productive use versus addiction.

The results showed very clear findings. Self-determined motivation factors such as game efficacy are more closely related to productive game use, not addiction. Conversely, need frustration factors such as academic stress are more closely related to game addiction. "The results indicate that factors related to self-determined motivation are more closely linked to adaptive game use. Conversely, those about need frustration are more closely associated with game addiction" (Choi et al., 2025, p. 7). Even more interesting is the finding that academic stress strengthens the transition from productive use to addiction. "The relationship between academic stress and GA ($\beta = 0.165$, $p < 0.01$) is more potent than that between AS and AGU ($\beta = 0.104$, p

Methodologically, this study is strong because it uses PLS-SEM, which allows for a direct comparison of factors contributing to adaptive game use versus game addiction. I appreciate the SDT theoretical approach, which provides a systematic framework for understanding the complexity of gaming behavior, rather than simply viewing gaming as a single activity. The finding that gender is not significantly associated with gaming addiction is also interesting because it challenges the myth that men are more vulnerable, suggesting that social and psychological factors are more important than demographics. A weakness is that the study uses cross-sectional data, so it cannot directly examine changes over time, even though the theoretical model assumes a transition from adaptive use to addiction.

For me, this study is highly relevant because it provides an important nuance: not all gaming is bad, and there is a fundamental difference between healthy gaming and addiction. For informatics students like myself, it provides perspective that technology can be used positively or negatively depending on the user's life context, and the focus of interventions should not be solely on the technology but on the individual's holistic well-being.

Comparison with Previous Papers: While Pirrone et al. (2024) focused on how game design, specifically reward elements, contributes to problematic gaming, and Lee et al. (2024) focused

on game efficacy as a moderator of the relationship between stress and excessive gaming, while Choi et al. (2025) elevated the analysis to a higher level by distinguishing between productive use and addiction. Pirrone addressed "what is in the game that is risky," Lee addressed "who is more vulnerable and why," while Choi addressed "how someone transitions from a healthy player to an addicted player." Pirrone employed an empirical approach with linear regression and focused on game design variables such as random and social rewards, Lee employed longitudinal panel data focusing on the interaction of stress and efficacy, and Choi employed a theoretical approach based on SDT with SEM to distinguish pathways toward adaptive use versus addiction. These three papers complement each other: Pirrone provides a technology design perspective, Lee provides an individual psychological perspective on coping with stress, and Choi provides a motivational perspective that distinguishes positive from negative use. For practitioners and policymakers, these three papers demonstrate that solutions to gaming addiction must be multifaceted, encompassing ethical game design (Pirrone), stress management-based interventions (Lee), and addressing real-life need frustration (Choi).

PAPER 4:

TwoSides of the Same Virtual Coin: Investigating Psychosocial Effects of Video Game Play, including Stress Relief Motivations as a Gateway to Problematic Video Game Usage

George Farmer 1,* and Joanne Lloyd

The study by Farmer & Lloyd (2024) provides a very different experimental approach than the previous three papers. While the previous papers used longitudinal or panel survey data to identify factors that trigger problematic gaming behavior, this paper conducted a controlled experiment to test the direct effects of gaming on stress and affect levels. The study aimed to test whether exposure to gaming reduced biological stress responses, increased positive affect, and reduced negative affect, and whether these effects were stronger in players with gaming disorder. As the researchers stated, "This research will investigate the correlations between stress (at both a biological and a self-reported level), video gaming, and (self-reported) problematic video gaming behaviors, grounded in Kardefelt-Winther's compensatory internet use theory" (Farmer & Lloyd, 2024, p. 4).

The motivation for this study was to understand the direct mechanisms behind the psychological benefits of gaming. Many people use gaming as a way to calm themselves or combat boredom, but the question is whether these effects could be a gateway to addiction. "Video gamers can play to negate the psychological impact of stress, which may become problematic when users over-rely on the stress-relieving potential of gaming" (Farmer & Lloyd, 2024, p. 2). This suggests that games are not simply entertainment products, but also psychological tools that can be used consciously or unconsciously to avoid real-world problems. This question is particularly relevant because if games are truly effective in reducing stress, then repeated use as a coping strategy could develop into an addiction.

This study uses Kardefelt-Winther's (2015) theory of compensatory internet use as a theoretical framework. This theory states that internet and gaming use is not simply an addiction, but rather a response to frustrated social needs in the real world. "Kardefelt-Winther responded to the discourse on internet addiction by suggesting that internet usage could be explained as a compensatory mechanism... In theory, users experience a lack of social resources (e.g., social

capital or cognitive arousal) offline, and therefore increasingly rely on the internet and the online stratosphere to provide experiences that provide the resources they lack" (Farmer & Lloyd, 2024, p. 3). This theory provides a strong basis for the hypothesis that gaming can become a maladaptive coping tool if used excessively to avoid stress, as it provides psychological resources lacking in real life.

In terms of methods, this study used a repeated-measures experimental design with 40 students at the University of Wolverhampton. The procedure began with participants completing questionnaires on affect (PANAS), stress (PSS), and gaming disorder (IGDS9-SF), then playing Mario Kart 8 Deluxe for 20 to 30 minutes, and then completing the same questionnaire again, along with heart rate measurements. "For the purposes of the study, Mario Kart 8 Deluxe (Nintendo) was used, along with a Nintendo Switch console (Nintendo, Wolverhampton, UK)" (Farmer & Lloyd, 2024, p. 6). This game was chosen strategically because it is easy to play, popular, and has common features such as daily rewards. This experimental approach allowed the researchers to measure the immediate effects of gaming, rather than just correlations as in survey studies.

The results of the experiment showed highly significant findings. Heart rate decreased by an average of 4.7 ms ($t(36) = 4.82$, $p < .001$), positive affect scores increased by an average of 3.32 points ($t(39) = 3.62$, $p < .001$), and negative affect scores decreased by an average of 1.80 points (Wilcoxon signed ranks test, $p < .001$). This provides direct empirical evidence that gaming has a tangible effect on stress and mood, even over a short period of time. Interestingly, however, hypotheses H4 and H5 were not supported, as there was no significant correlation between levels of gaming disorder and changes in affect or heart rate. "The results did not support the prediction that problematic gaming scores would be associated with a more pronounced change in affect as a result of playing the game, which was unexpected and does not support H4. The results also did not support the prediction that there would be an association between the difference in IPR scores measured after exposure to video game play and gaming disorder scores, which refuted H5" (Farmer & Lloyd, 2024, p. 10). This means that the stress-relief effect of gaming is universal and not stronger in players who already experience gaming disorder.

This study concluded that gaming has a significant effect on stress and mood, even over a short period of time, and this effect was not stronger in players who already had a gaming disorder. "The results suggest that video games have a measurable effect on biological stress, when isolated to a short gaming session within a laboratory environment. Exposure to the video game decreased stress levels compared to pre-experimental levels, which supports H1" (Farmer & Lloyd, 2024, p. 10). This suggests that the stress-relief benefits of gaming are universal, not just for those who are vulnerable. This finding is important because it suggests that addiction is not due to problem players experiencing greater positive effects, but rather to habit, dependence, and an inability to stop on their own.

Methodologically, this study has significant strengths because it uses an experimental approach that provides direct empirical evidence of gaming's effects, not just correlations. Biological measurements such as heart rate provide objectivity not available in survey studies. I appreciate the focus on the direct mechanisms by which gaming works at the physiological and psychological levels. However, this study also has limitations. First, the lack of a control group means we don't know whether these effects are due to the game or simply the natural relaxation

of the lab. Second, the short duration of the experiment (20 to 30 minutes) doesn't reflect the typical pattern of excessive gaming, which typically lasts for hours. Third, the selection of casual, non-competitive games may have different effects than more intense or competitive games.

For me, this study provides direct empirical confirmation of what has long been suspected: games are indeed effective as a stress-reducing tool. However, the finding that this effect is not stronger in problem players is particularly interesting because it challenges the assumption that addiction is caused by an oversensitivity to rewards. For informatics students like me, this suggests that games have real therapeutic potential, but also risks when used as a sole coping strategy.

Comparison with Previous Papers: While Pirrone et al. (2024) used a longitudinal survey to identify risky reward elements in games, Lee et al. (2024) used a longitudinal survey to examine stress and game efficacy as moderators, and Choi et al. (2025) used a longitudinal survey to distinguish between self-determined motivation and need frustration, while Farmer and Lloyd (2024) used a controlled experiment to examine the direct effects of gaming on stress and mood. Pirrone focused on what in gaming is risky (random, social, contingent rewards), Lee focused on who is vulnerable (those with high academic stress and gaming efficacy), Choi focused on why the transition from adaptive to addictive use occurs (need frustration), while Farmer focused on how gaming works directly (stress-relief effects). Pirrone found that certain reward elements increase the risk of problematic gaming, Lee found that academic stress plus gaming efficacy leads to excessive gaming, Choi found that self-determined motivation leads to adaptive use while need frustration leads to addiction, and Farmer found that gaming reduces stress but not more in problem players. These four papers complement each other perfectly: Pirrone provides a technology design perspective, Lee provides an individual psychological perspective, Choi provides a motivational perspective, and Farmer provides direct experimental evidence. For practitioners, these four papers demonstrate that solutions to gaming addiction must be comprehensive, encompassing ethical game design, stress management interventions, addressing real-life need frustration, and an understanding that games do have real stress-relief effects but must be used wisely.

DAFTAR PUSTAKA

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