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Original Investigation

Experiencing Deep Immersion in Computer Games is Associated with Autotelic Engagement and Leads to Addiction

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Purpose: The main aim of the study was to examine the relationship between immersion and autotelic engagement in computer gaming addicts and competitive esports players. Research suggests that autotelic engagement enables gamers to experience deep immersion, which may contribute to loss of control over virtual experiences and lead to gaming addiction.
Methods: The study included three groups: gaming addicts (N = 29, mean age = 22.34 ± .97 years), esports players (N = 29, mean age = 23.04 ± 1.12 years), and a control group of non-gamers (N = 29, mean age = 21.78 ± 1.03 years). All participants were male and between 19 and 25 years old. The FLOW Engagement Questionnaire and the Immersiveness of Games Questionnaire were used to measure immersion and autotelicity. Group comparisons were conducted across all questionnaire dimensions, and correlation analyses were performed separately for each group.
Results: Compared to esports players and non-gamers, gaming addicts exhibited higher levels of clear goal perception (by 11.7% and 12.7% respectively, $P < .05$), concentration on the task at hand (by 13.2% and 12.9% respectively, $P < .05$), and interaction with the game environment (14 % and 10.5% respectively, $P < .05$), while reporting lower awareness of the real world (by 24.6% and 21.2% respectively, $P < .05$). Additionally, compared to non-gamers, addicted players showed greater challenge-skill balance (by 10.3% and 15.4% respectively, $P < .05$) and a higher sense of control (by 10.5% and 14.3% respectively, $P < .05$). Moderate and strong correlations between immersion and autotelicity were found across all three groups, but these correlations were generally weaker in addicted gamers, suggesting a more fragmented pattern of engagement.
Conclusions: Autotelic engagement appears to facilitate deep immersion, which may, in turn, increase susceptibility to gaming addiction. Individuals with high autotelic tendencies may be particularly at risk.

Keywords: esports players, problematic gaming, autotelic experience, virtual environment, health prevention

Introduction

Computer gaming provides a sense of visual presence and tends to be immersive. When gamers fully commit to the activity, their engagement is often autotelic.[1] Autotelic engagement refers to an activity pursued for its own sake, bringing enjoyment through the challenge it presents. Immersion, on the other hand, is a mental state characterized by deep involvement, joy, and a diminished awareness of time and space.[2] Csikszentmihalyi et al.[3] argue that certain conditions must be fulfilled for autotelic engagement to arise: an equilibrium between skill level and challenge, clearly defined goals, and immediate feedback. These conditions are closely tied to cognitive abilities.[4] Research on computer gamers has identified three primary sources of attention-visual, auditory, and mental[5] revealing that the depth of immersion experienced by players is linked to the number and intensity of these attentional factors.

The ability to focus attention, understood as controlling one's own actions, along with wakefulness, defined as maintaining awareness of the real world,[5] can reduce susceptibility to immersion in computer games while simultaneously reinforcing a sense of control over reality. This is closely tied to the player's intention, as they initially influence what is conveyed through the game interface and anticipate its outcomes. Csikszentmihalyi's influential research[6] emphasizes that intense concentration on present actions is a key prerequisite for entering a subjective space, with a sense of challenge being essential. For immersion to occur, players must be able to pursue multiple potential goals[7] while also finding the activity inherently rewarding. Moreover, deep immersion can be closely linked to an autotelic personality,[4, 8] a phenomenon referred to as autotelic immersion—where autotelic engagement combines with a creative sense of absorption in virtual reality.

Immersion in exotelic and autotelic engagement

A player with an exotelic personality, who maintains greater awareness of the real world and lacks autotelic engagement, may struggle to block out external distractions, making deep immersion unattainable.[9] For novice players, the novelty of the game environment may capture their attention so intensely that they experience a threshold moment—a transition from everyday reality to imagined experiences within their mind.[9] However, as players become more familiar with the game interface, their attention can become automated, allowing engagement to develop and immersion to increase, though only to a certain degree. Initially, players remain aware that they are interacting with a virtual world of their own creation,[9] but the key question is whether this digital reality feels convincing enough to override their sense of control. Given the cognitive demands of processing both visual and auditory stimuli simultaneously, greater effort is required to maintain gameplay focus. In contrast, autotelic engagement in virtual reality often fosters an immediate sense of trust in the experience, making players naturally inclined to embrace the game world.[10] An autotelic personality helps dissolve skepticism, enabling players to immerse themselves more fully by deliberately disregarding cues that highlight the artificial nature of their surroundings. Initially, players may consciously simulate belief in the game's reality,[11] particularly when they derive significant enjoyment and cognitive stimulation from playing. However, with repeated and extended gameplay, those who engage autotelically are more likely to experience deep immersion, which can eventually weaken their ability to regulate their virtual experiences. Over time, this heightened engagement may lead to a sense of indispensability regarding the virtual world.

We propose that the pursuit of immersion, driven by players' expectations of mental engagement, causes them to leverage their autotelic tendencies to reinforce—rather than critically evaluate—the perceived reality of their virtual experiences. This process can, in turn, contribute to emotional dependence on the game environment.

Computer game addiction and esports

Computer game addiction is a multifaceted issue that involves both internal factors—such as mood regulation and decision-making processes—and external influences, including family support and socio-economic conditions.[12] Additionally, individual personality traits, such as a preference for immediate gratification and difficulties in impulse control, have been identified as contributing factors to the development of gaming addiction. Problematic gaming can negatively impact interpersonal relationships and lead to symptoms commonly associated with addictive behaviors.[13] It is also suggested that one consequence of digitization is a decline in traditional risk behaviors,[14] as modern civilization and rapid technological advancements have transformed how young people communicate, socialize, acquire knowledge, and engage in leisure activities.

Gaming addiction is typically diagnosed when an individual exhibits at least five distinct behavioral patterns over a 12-month period.[15] Research indicates that excessive gaming, particularly when associated with addiction, is correlated with psychomotor hyperactivity, irritability, aggressive behavior, heightened social anxiety, and diminished self-esteem.[15] However, within the realm of esports, gaming addiction may be less common, as, despite spending extensive hours in front of computers, esports players are primarily motivated by competitive goals rather than engaging in gaming for its own sake. Nevertheless, deep immersion accompanied by autotelic engagement can blur this distinction, as the pursuit of competitive success may gradually transform into gaming for the intrinsic pleasure of the activity itself.

Social costs of computer game addiction

The professional gaming industry is expanding rapidly across highly developed nations. In certain Asian countries, the prevalence of gaming addiction among adolescents is estimated to be as high as 15%, while in Western Europe, the rate is approximately 10%.[16] The financial burden of gaming addiction is substantial, with South Korea alone incurring annual costs of $3.5 billion, primarily due to addiction treatment facilities and losses in productivity.[17] The growing popularity of esports raises concerns that problematic gaming patterns may become increasingly common. Children and adolescents, in particular, are highly susceptible to addictive behaviors.[18] Excessive time spent playing/enjoying esports can affect their lives in areas such as learning, mental well-being and development.

Given the recent inclusion of Gaming Disorder in the ICD-11 International Classification of Diseases, it is especially important to advocate for global public health initiatives aimed at developing strategies to prevent the onset of problematic gaming, including within the esports sector. Professional players additionally need to perform well at tournaments, resulting in the need to spend long hours training, which takes up most of their daily lives. Very often, professional players suffer from back strain, as they have to sit for up to a dozen hours a day without much motor movement.[19] Physical activity makes people happier by increasing serotonin levels, whereas playing computer games for long periods of time can lead to depression and social problems, and in adolescents also such as poorer academic performance and behavioral problems.[20] Moreover, prolonged gaming can induce long-term changes in the brain's reward circuitry, mirroring the neurological effects observed in substance addiction.[21.]

The main aim of the study was to examine the relationship between immersion and autotelic engagement in computer gaming addicts and competitive esports players

Method

Participants

Participation in the study was anonymous, and all participants provided written informed consent before taking part. The participants trained several days a week and competed in esports tournaments. All participants declared that they identified as male. The study included three groups: an experimental group of gaming addicts or "problem gamers" (N = 29), an experimental group of esports players (N = 29), and a control group (N = 29). All participants were between 19 and 25 years old. The average age of the addicted players was 22.34 ± .97 years, the esports players 23.04 ± 1.12 years, and the control group 21.78 ± 1.03 years.

The inclusion criteria for the game-addicted group required a positive score on the Game Addiction Scale and a self-reported history of playing computer games for at least 20 hours per week over a period of six months or longer. The exclusion criterion for this group was participation in esports competitions. The inclusion criteria for the esports group required participants to have competed in esports tournaments at least three times in the past six months and to have played computer games for a minimum of 20 hours per week over the past six months or longer. An exclusion criterion for the esports group was a positive score for addiction on the Game Addiction Scale. The control group, in turn, included individuals who had no history of intensive gaming (more than 20 hours per week) and had played no more than one hour per week in the past six months.

All participants were required to report their height and weight. The average height and weight of the addicted group were 178.23 ± 3.48 cm and 78.05 ± 5.32 kg, respectively. The esports group had an average height of 176.11 ± 4.49 cm and an average weight of 77.44 ± 4.19 kg, while the control group had an average height of 178.35 ± 4.07 cm and an average weight of 79.29 ± 5.02 kg.

The most commonly used gaming platforms among participants included computers, web browsers, mobile phones, stationary consoles (Xbox, and PlayStation). Participants engaged in a variety of game genres, such as action, racing, fighting, and sports games. The duration of gaming experience varied widely, ranging from one to twelve years. Typical gaming sessions lasted between 15 and 60 minutes, with players engaging in one to two sessions per day.

The study employed two self-report questionnaires, the Immersiveness of Games Questionnaire (ING) and the FLOW Engagement Questionnaire, both of which were administered via an online browser. The interpretation of both questionnaires was based solely on numerical results, calculated as the sum of responses to each question according to the scoring key. The numerical results were expressed in arbitrary units (a.u.).

The Immersiveness of Games Questionnaire (ING), proposed by L. Kent Norman,[22] was translated from English into Polish for the purposes of this study. The questionnaire is designed to assess subjectively perceived immersion, with a particular focus on the characteristics of computer-generated environments. While the psychometric properties of the questionnaire, as assessed in studies utilizing virtual reality, appear promising, further evaluation is required to confirm the tool's accuracy. Based on the results of factor analysis conducted in experiments involving virtual reality, the interface awareness scale was combined with the environment awareness scale, leading to a more stable structure. The questionnaire comprises 27 items, organized into two main scales.

The positive scale includes four dimensions: Interaction with the Environment (IE), Sense of Control (SC2), Auditory Presence (AP), and Sensory Presence (SE). The negative scale concerns Awareness of the Real World (AW), where a high score indicates a lower level of immersion. Conversely, a high score on the positive scale reflects a greater level of experienced immersion.

The Flow State Scale-2 (FSS-2) is used to assess subjective experiences of autotelic engagement. The scale measures nine dimensions of this state, with responses rated on a five-point scale. Each dimension is represented by four statements. The individual dimensions assessed are as follows: Challenge-Skill Balance (CB), Merging of Action and Awareness (AA), Clear Goals (CG), Unambiguous Feedback (UF), Concentration on the Task at Hand (CT), Sense of Control (SC1), Loss of Self-Consciousness (LF), Distorted Sense of Time (DS), and Autotelic Experience (AE).

Statistical analysis

All analyses were performed using the Statistica_13.3_PL package (StatSoft Sp. z o.o., Cracow, Poland). The assumption of normality for each group was assessed using the Shapiro-Wilk test ($\alpha = .05$). For variables that met the normality assumption, statistical significance was evaluated using a one-way ANOVA, with effect size assessed using eta squared. Post-hoc comparisons were conducted using Tukey's test. When the normality assumption was not met, group distributions were compared using the Kruskal-Wallis test, with effect size measured using eta squared with ranks. In such cases, Dunn's test was applied for post-hoc analysis. To examine relationships between dimensions of the two questionnaires used in the study, Spearman's rho (R_s) correlation coefficient was calculated. The strength of correlation was categorized as moderate ($.4 < R_s \leq .6$), strong ($.6 < R_s < 1$), or perfect ($R_s = 1$).

Results

Intergroup comparison in dimensions of immersion and autotelicity

Significant intergroup differences were observed in terms of six of the dimensions measured (Table 1). Compared to competitive esports players and non-gamers, addicted gamers exhibited significantly higher levels of clear goal perception (by 11.7% and 12.7% respectively, $P < .05$), concentration on the task at hand (by 13.2% and 12.9% respectively, $P < .05$), and interaction with the game environment (14 % and 10.5% respectively, $P < .05$), while their awareness of the real world was significantly lower (by 24.6% and 21.2% respectively, $P < .05$). Mean difference (M dif.) between addicted players and control group in CG was 1.97 ± .78 a.u. ($P < .05$), in CT was 2.05 ± .67 a.u. ($P < .05$), in IE was 3.65 ± 1.47 a.u. ($P < .05$) and in AW was 3.89 ± 1.75 a.u. ($P < .05$). Additionally, in comparison to the control group, addicted gamers demonstrated a stronger sense of challenge-skill balance (M dif. = 2.31 ± .70 a.u., $P < .05$) and a higher sense of control (M dif. = 4.93 ± 1.49 a.u., $P < .05$). No significant differences were found between the esports group and the control group. However, a notable difference was detected in the sense of interaction with the game environment between addicted gamers and esports players (M dif. = 4.72 ± 1.63 a.u., $P < .05$), whereas no such difference was observed between addicted gamers and the control group. No significant intergroup differences were identified in the remaining dimensions. These findings indicate that addicted gamers differ significantly from the broader population, including esports players and non-gamers, across multiple dimensions of immersion and autotelicity. The observed differences may reflect characteristics associated with the development of gaming addiction.

Table 1. Comparison between groups of addicted players, esports players and control group in dimensions of autotelicity and immersion. Values given in arbitrary units (a.u.).

		Addicted Players (group 1)		E-sport Players (group 2)		Control (group 3)		F/H	P	η²/ η²_H	Sig. Post-hoc b/w groups 1, 2 and 3
	Dim.	**M**	**SD**	**M**	**SD**	**M**	**SD**				
Dimensions of autotelicity	**CB**	17.31	2.63	15.69	3.41	15.00	2.71	9.99* (H)	.006	.09	1-3*
	AA	15.66	4.58	14.90	3.42	15.24	2.87	1.14 (H)	.56	-.01	NA
	CG	17.45	2.72	15.62	3.19	15.48	3.21	8.14* (H)	.01	.07	1-2*, 1-3*
	UF	16.72	3.60	15.17	3.72	15.62	2.98	4.10 (H)	.12	.02	NA
	CT	18.03	2.11	15.93	2.79	15.97	2.96	10.41* (H)	.005	.09	1-2*, 1-3*
	SC1	15.93	3.60	15.17	2.98	15.31	2.89	1.99 (H)	.36	-.01	NA
	LF	14.76	3.80	14.00	3.25	15.17	3.04	.89 (F)	.41	.02	NA
	DS	13.52	5.79	14.52	4.11	15.10	3.90	.40 (H)	.81	-.01	NA
	AE	17.59	2.90	15.83	3.34	15.62	3.51	6.67* (H)	.03	.05	NA

	Dim.	Addicted Players (group 1) M	SD	E-sport Players (group 2) M	SD	Control (group 3) M	SD	F/H	P	η²/ η²_H	Sig. Post-hoc b/w groups 1, 2 and 3
Dimensions of immersion	IE	38.41	6.04	33.69	6.39	34.76	5.12	5.15* (F)	.007	.11	1-2*
	AP	16.72	4.46	15.17	3.65	15.38	3.02	5.60 (H)	.06	.04	NA
	SP	24.07	6.72	24.52	3.85	22.76	3.90	.96 (F)	.38	.02	NA
	SC2	39.41	6.20	35.66	7.43	34.48	5.12	4.81* (F)	.01	.10	1-3*
	AW	14.45	7.23	19.17	6.85	18.34	6.12	9.95* (H)	.006	.09	1-2*, 1-3*

Note: Dim = Dimensions; M = Mean; SD = Standard Deviation; F = ANOVA Fisher value; H = Kruskal-Wallis H-test value; η² = Eta-squared effect size; η²_H = Eta-squared effect size for ranks. Sig. Post-hoc = Significance of post-hoc tests between group 1, 2 and 3 (Tukey HSD for ANOVA Fisher value or Dunn Test for Kruskal-Wallis H-test).
CB = Challenge-Skill Balance; AA = Merging of Action and Awareness; CG = Clear Goals; UF = Unambiguous Feedback; CT = Concentration on the Task at Hand; SC1 = Sense of Control; LF = Loss of Self-Consciousness; DS = Distorted Sense of Time; AE = Autotelic Experience; IE = Interaction with the Environment; AP = Auditory Presence; SP = Sensory Presence; SC2 = Sense of Control; AW = Awareness of the Real World.
"*" - $P < .05$.

Relationships between immersion experience and autotelic engagement.

A substantial number of moderate and strong correlations were observed between dimensions across all three groups (Table 2). In the addicted gamers group, 11 moderate correlations ($.4 < R_s \leq .6$, $P < .05$) and 6 strong correlations ($.6 < R_s < 1$, $P < .05$) were identified. Among esports players, 18 moderate correlations ($.4 < R_s \leq .6$, $P < .05$) and 15 strong correlations ($.6 < R_s < 1$, $P < .05$) were detected. In the control group, 13 moderate correlations ($.4 < R_s \leq .6$, $P < .05$) and 31 strong correlations ($.6 < R_s < 1$, $P < .05$) were observed. The presence of numerous correlations across all groups suggests a shared underlying phenomenon linking immersion and autotelic engagement. However, differences in the number and strength of correlations between groups may reflect the distinct characteristics of each population. Non-gamers exhibited a more homogeneous pattern of behavior, whereas esports players displayed greater variability. This variability was even more pronounced among addicted players, who demonstrated individual patterns of addiction. The hypothesis of heterogeneity within the gaming population is further supported by the lowest p-values found for the addicted gamers group across most tested dimensions, except for the SP (Sensory Presence), IE (Interaction with the Environment), and SC2 (Sense of Control) parameters, as indicated by the normality distribution tests.

Table 2. Correlation matrix between the dimensions of autotelicity and immersion.

Groups	Dimensions	CB	AA	CG	UF	CT	SC1	LF	DS	AE
Addicted players	IE	.266	.445*	.626*	.473*	.471*	.547*	.542*	.126	.275
	AP	.069	.279	.454*	.320	.390*	.274	.198	.367	.106
	SP	.228	.132	.435*	.343	.257	.379*	.315	.120	.098
	SC2	.674*	.538*	.772*	.773*	.413*	.817*	.626*	.003	.474*
	AW	-.091	-.048	-.173	-.089	.145	.083	.363	.575*	-.092
Esport players	IE	.737*	.781*	.574*	.725*	.734*	.449*	.104	.390*	.627*
	AP	.627*	.471*	.483*	.627*	.701*	.557*	.321	.165	.550*
	SP	.503*	.398*	.410*	.525*	.555*	.482*	-.027	.185	.438*
	SC2	.765*	.757*	.788*	.824*	.744*	.710*	.143	.472*	.848*
	AW	-.321	-.196	-.525*	-.349	-.404*	-.398*	.183	.098	-.48*
Control group	IE	.703*	.633*	.756*	.862*	.703*	.633*	.756*	.862*	.842*
	AP	.638*	.452*	.647*	.655*	.628*	.452*	.645*	.65*	.579*
	SP	.562*	.468*	.488*	.409*	.562*	.468*	.488*	.409*	.366
	SC2	.801*	.647*	.871*	.790*	.801*	.647*	.871*	.790*	.776*
	AW	.747*	.579*	.821*	.817*	.747*	.579*	.821*	.817*	.770*

Note. CB = Challenge-Skill Balance; AA = Merging of Action and Awareness; CG = Clear Goals; UF = Unambiguous Feedback; CT = Concentration on the Task at Hand; SC1 = Sense of Control; LF = Loss of Self-Consciousness; DS = Distorted Sense of Time; AE = Autotelic Experience; IE = Interaction with the Environment; AP = Auditory Presence; SP = Sensory Presence; SC2 = Sense of Control; AW = Awareness of the Real World.
"*" - $P < .05$; Numerical values in the table represent Spearman's rho (R_s)

Discussion

The statistical analyses presented in this study indicate that autotelic engagement in gamers facilitates deep immersion during gameplay. However, while immersion enhances engagement, it may also blur the boundary between virtual and real experiences, potentially leading to addiction. We propose that in problematic gaming, autotelic engagement sustains behavior that becomes an end, reinforcing compulsive play. Competitive esports players, in contrast, may be less susceptible to this risk, as their primary motivation lies in pursuing the objective of winning, rather than engaging in gameplay for its own sake.

Previous research has found[23, 24] that highly immersive computer games also generate strong social presence and are positively associated with users' perceived utility and hedonistic motivation. These factors may contribute to higher levels of participation and autotelic engagement, further reinforcing gaming behaviors. Several studies[13, 15, 25] have shown that intensive gaming, especially when accompanied by symptoms of addiction, is linked to psychomotor hyperactivity, irritability, aggressive behavior, heightened social anxiety, depression, and lowered self-esteem. Additionally, Bójko et al.[26] identified problematic gaming as both a barrier to developing emotional competencies and a marker of pre-existing social relationship difficulties.

Despite these risks, computer games are increasingly being integrated into educational settings. For example, in 2016 year, the "Media School" Foundation launched the "Gamedactics: Education Through Games" project, which culminated in a scientific study[27] on the use of computer games in school education. While educational games aim to convey knowledge in innovative ways,[28] they nevertheless make extensive use of gamification-based mechanisms[29] which – although they differ from commercial entertainment titles in terms of complexity and graphical sophistication, they may in fact do more harm than good, inadvertently contributing to problematic gaming behaviors.

Reliable prevalence rates of Internet Gaming Disorder (IGD) remain difficult to establish across different populations due to methodological limitations in assessment and cross-cultural comparisons. However, findings from multiple studies[30, 31, 32, 33] indicate that IGD prevalence is alarmingly high in many countries. Bójko et al. suggest that the growing percentage of problematic gamers may be linked to the significant rise in adolescent mobile media use in recent years.[26.]

The Internet Gaming Disorder (IGD) has been included in the latest version of the International Classification of Diseases, reflecting its growing recognition as a significant health concern.[34, 35, 36, 37] In addition to "Disorder Games" (6C51), the ICD-11 also introduces the category of "Hazardous Gaming" (QE22), further highlighting the need for systematic diagnostic and intervention strategies. The American Psychiatric Association (APA) has also proposed a definition of Internet Gaming Disorder (IGD),[1] offering a valuable foundation for the clinical diagnosis and understanding of the disorder, providing a solid starting point for addressing this issue.

Practical Applications

Preventing addiction requires early identification of the traits that predispose individuals to compulsive behaviors, and this principle applies equally to gaming addiction. Understanding the relationship between autotelic immersion and gaming addiction susceptibility is a critical first step in developing targeted prevention strategies. Recognizing that a child or adolescent exhibits autotelic tendencies should prompt parents, educators, and caregivers to pay special attention to their gaming habits. By identifying these predispositions early, individuals with a high risk of problematic gaming can be guided toward less addictive and less physically or mentally harmful activities, helping to mitigate the potential negative effects of excessive gaming.

Conclusions

The findings of this study suggest that autotelic engagement serves as a key facilitator of deep immersion, which may increase susceptibility to gaming addiction. Individuals with a strong propensity for autotelic engagement appear to be particularly at risk of developing problematic gaming behaviors. Identifying traits predisposing individuals to addiction is crucial for effective prevention and intervention strategies. One potential avenue for future research is the development of more objective diagnostic techniques, such as electroencephalography (EEG), to replace or supplement self-report tools. EEG could help identify neural correlates of autotelic immersion, which may serve as biomarkers for gaming addiction susceptibility. This hypothesis requires further investigation. Additionally, the authors intend to continue to explore the role of relaxation programs in reducing muscle tension and mitigating the physiological effects of prolonged gaming. Addressing both psychological and physiological factors may offer a more comprehensive approach to understanding and managing gaming addiction.

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Ethical Committee approval

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Topic

Science of addiction

Conflicts of interest

The authors have no conflicts of interest to declare.

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Author-s contribution

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