Gender Differences in Immersive Reading With Interactive Electronic Picture Books

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Abstract **– This study examined the effectiveness of interactive electronic picture (IEP) books during immersive reading, impact on mental health education, and integrating gaming elements in educational settings. The mixed-methods experiment combined quantitative data from surveys with qualitative insights from in-depth interviews. The findings revealed that males have higher levels of immersion during interactive reading. This study contributes to digital learning by providing empirical evidence on the benefits of integrating interactive technology into education as well as emphasizing IEP books' potential to revolutionize mental health education and the importance of considering gender differences when designing educational tools.**

Keywords **– Interactive electronic picture books, mental health education, immersive reading, game immersion.**

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1. Introduction

The metaverse digitization wave has significantly altered learning modalities. Digital learning and gaming have become integral to modern education and cognition. Experience designs centered on digital interaction bring additional benefits by emerging as new tools for inspiring thought and learning [1], [2]. This shift has been pronounced during the COVID-19 pandemic and has accelerated the need for medical education and self-care methodologies at home. The demand for remote digital learning interaction designs and the development of positive health education concepts has garnered increased attention, indicating room for improvement in health education methods.

To further explore why players favor interactive gaming experiences, understanding the factors that draw users into immersion is crucial. This study focuses on observations of factors, such as the degree, duration, or mode of user participation in immersion, to assess the feeling caused by the interactive design of games or user experiences [3]. Immersive experiences apply to entertainment games and the learning effectiveness of educational games [4].

Books are the most direct learning tool used in traditional learning processes. However, reading modes have gradually shifted from traditional paper books to digital e-books. Research suggests that digital interactive picture books, along with their interactivity, dynamic images, and other features, help readers understand complex theories, storylines, and imaginative spaces [5]. Electronic picture books have become an integral part of children's daily lives, shaped by the widespread use of various technological tools, such as televisions, smartphones, tablets, and computers, which influence their modes of communication, entertainment, and learning.

This study explored the impact of IEP books on users' immersive reading experiences.

By observing readers' processes, allowing a deeper understanding of the immersive feelings evoked by integrating interactive technology into knowledge-based reading and serving as foundational research for interactive design applications. Additionally, it sought to understand the application of IEP books as a serious game in mental health education. This study's objectives are as follows:

I. to investigate how the IEP book influences immersive reading experiences across different genders.

II. to evaluate the feasibility of using an IEP book format to deliver health education.

In our work, we first provide a brief overview of immersive experiences, interactive technology, and picture book applications in Section 2. Section 3 outlines the research methodology. Section 4 presents the survey results. In Section 5, we draw conclusions and discuss the findings based on the research results. Finally, Section 6 explains the study's conclusions.

2. Theoretical Framework and Related Work

This section examines the theoretical underpinnings and existing literature concerning immersion experiences, interactive technologies, and their integration into educational tools. Through a comprehensive review of these topics, the study aims to highlight how these concepts inform and support the investigation of immersive learning methodologies and the design of interactive picture books.

2.1. Immersion Experience

The Flow Theory, initially proposed by Csikszentmihalyi [6], is frequently referenced in discussions on experiential design and game immersion. It describes a motivating and pleasant sensation, or an "optimal experience," people feel during everyday activities. Recently, it is often used as a metric for experiential design, game immersion, and computer education [7], [8]. Research has focused on how to measure students' flow states while using computers for learning, designing learning activities to help students achieve a state of flow, and determining the correlation between the state of Flow and the enhancement of students' learning abilities. The flow theory is a comprehensive framework that integrates motivation, personality, and subjective experiences [9].

Furthermore, Moneta and Csikszentmihalyi introduced the experience fluctuation model, a flow dimension framework based on the difficulty levels of learning challenges and individual skills [10].

This model identifies eight distinct emotional states, including apathy, boredom, worry, anxiety, relaxation, control, arousal, and flow [11]. When tasks are perceived as too easy, users may experience apathy or boredom; conversely, tasks perceived as overly difficult can induce anxiety. A state of flow is achieved when both the challenge level and skill proficiency are high.

The degree of user immersion is considered a critical metric for evaluating game quality, as it is highly correlated with game enjoyability [12], [13]. A comprehensive game experience questionnaire was proposed by researchers in [14], designed to assess the quality of game content and evaluate player satisfaction with their gaming experience. This questionnaire utilized a modular structure and employed an analytic hierarchy process to examine various aspects of player experiences, such as tasks, problems, and challenges [14]. In a separate study, the concept of game immersion was investigated using grounded theory, which proposed three distinct stages: engagement, engrossment, and total immersion [15]. In-depth interviews with experienced gamers were conducted to define these varying levels of immersion.

Cheng *et al*. [4] further expanded upon these stages of immersion theory, developing a three-stage immersion scale to measure the learning effectiveness of serious educational games (SEGs) and non-commercial games with an educational focus. The first stage, engagement, reflects a player's preference for a game genre and their willingness to invest time and effort. The second stage, engrossment, is characterized by the player's emotions and moods being influenced by the game's narrative, with less attention paid to external surroundings. The final stage, total immersion, occurs when the player feels completely integrated into the game, experiencing a sense of disconnection from reality. The results validated the game immersion questionnaire (GIQ) as a method for measuring the impact of SEGs on immersive experiences and indicate that game-immersion experiences are beneficial for the learning effectiveness of serious games.

2.2. Interactive Technology and Picture Book Applications

Reading books is essential for acquiring knowledge but can present challenges for young children, students, and individuals with specific reading difficulties.

Illustrated picture books are among the most accessible forms of reading, relying primarily on graphics with supplemental text.

Recently, the popularity of e-books and digital publishing has grown significantly as the industry has shifted toward digitization and paperless formats. Traditional paperback picture books follow a story structure, presenting the narrative on single or multiple pages, while e-picture books incorporate game-like elements and guide users through interactive reading experiences based on their storylines [16], [17], [18]. Augmented reality (AR) is a form of interaction that combines virtual objects with real-world spaces through mobile devices and applications. Multimedia, such as animation, audio, video, and 3D models, are employed to create a multisensory reading experience, allowing readers to feel immersed in the creator's imagined world [19], [20].

Several intellectual games have been analyzed for their impact on the learning effectiveness of technology-enhanced learning. One study introduced a novel collaborative design paradigm for AR educational games, developed through rigorous case studies involving pedagogues and AR game design experts [21]. This paradigm shift advocates for a cross-disciplinary methodology in conceptualizing and developing educational technologies. Furthermore, depending on the subject matter, the content presented can take the form of 2D images or 3D stereoscopic models, which enhance students' logical thinking and observational skills, leading to improved learning outcomes [22].

Gyroscope sensors, often found in devices such as smartphones, tablets, and game controllers, measure a device's tilt and rotation, enabling real-world interactive experiences. These sensors are particularly useful for orientation and somatosensory interactions, such as wayfinding and object-finding activities [23], [24]. E-books that integrate AR, gyroscope sensing, and other interactive technologies can help raise learners' awareness of important topics and increase their motivation to learn, making them valuable tools for knowledge-based educational applications [25]. Additionally, the design of the device's interactive interface has a significant impact on user experience. Researchers have proposed that the interactive prompts within the IEP book should follow human-machine interface design principles, such as affordance, signifiers, predictability, feedback time, and learnability [26], [27]. For instance, cueing designs that incorporate both text and sound effects for buttons can enhance usability. Current interactive technologies for e-picture books rely primarily on touch screens or clicking devices to turn pages. Interactions using voice, gyroscopes, or other forms of interactive design are less common, though further advancements in digital reading technologies are expected in the future.

Recently, people have been affected by epidemics and environmental changes, which have caused helplessness and panic, causing the public to pay more attention to mental health issues. A study conducted between 2019 and 2021 reported data on the prevalence of depression and anxiety disorders during the pandemic [28]. These data were instrumental in estimating the disability-adjusted life years (DALYs) and years of life lost (YLL) that could be attributed to the pandemic. The study found that the total prevalence of these conditions was 4,802.4 cases (with a 95% confidence interval of 4,108.2 to 5,588.6) per 100,000 people. Regarding disease burden, major depressive disorder was responsible for 49.4 million DALYs (33.6-68.7 million). In comparison, anxiety disorders accounted for 44.5 million DALYs (30.2-62.5 million). Notably, women appeared to be disproportionately affected compared to men, and younger individuals were affected more than their older counterparts.

The COVID-19 pandemic affected several countries worldwide. Governments implemented various preventive measures to reduce the risk of infection with the aim of curbing pathogen transmission. However, these protective measures resulted in social isolation and hindered interpersonal interactions, leading to psychological and physiological imbalances [29]. Recent years have seen a trend toward earlier onset and an increased prevalence of depressive disorders. The probability of adolescents experiencing depression doubled during this period [30]. A systematic review and meta-analysis of longitudinal studies focusing on children and adolescents found a significant rise in depressive symptoms, especially among females and individuals from higher-income backgrounds [31]. During the pandemic, the World Health Organization (WHO) emphasized the importance of self-care, supporting loved ones, and recognizing the role of health education in promoting mental well-being [32]. Proper health education stabilizes the mind, body, and medical processes [30]. Digital tools for health education can effectively improve patients' health indicators and self-management and reduce depression if timely intervention is implemented in the healthcare process [33].

In summary, the literature supports the objectives of this study by demonstrating how immersive technologies and interactive design elements can enhance users' reading experiences and serve as viable tools for health education. This foundational understanding of immersion and interactivity provides a solid basis for evaluating the impact of IEP books on immersive reading and mental health education.

3. Methodology

This section outlines the experimental procedures and participant recruitment involved in this study, as well as the tools and assessments used to evaluate the impact of the IEP book on immersive learning and mental health education.

3.1. *Research Procedure*

This study's experiment was commenced by recruiting willing participants. The participants were required to complete several steps: (1) a pre-learning test using the Health Education Knowledge Assessment (HEKA), (2) interaction with the IEP book, (3) a post-learning HEKA test, and (4) the game immersion questionnaire (GIQ). All participants provided informed consent, and the study protocol received approval from the relevant ethics review board.

Before the experiment, researchers explained the procedure to each participant and introduced the interface icons in the IEP book. The reading process was then initiated, allowing participants to proceed at their own pace, with a maximum time limit of 40 minutes. All the questionnaires were anonymous. To ensure that the questionnaire was relevant to the topic and validity of the study, the respondents had to fulfill two criteria: they had at least one year of gaming experience and had previous experience with e-books. After completing all experimental steps, a random sample of participants was invited to participate in a post-experience interview regarding their interaction with the IEP book.

HEKA: The Health Education Knowledge Assessment (HEKA) pre- and post-tests were based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).

These tests were designed to evaluate participants' basic knowledge of adolescent depression and related concepts of appropriate support, such as understanding adolescent depression, identifying factors that influence depression, and recognizing effective methods of providing companionship to individuals with depression.

Game immersion questionnaire (GIQ): To assess user immersion, this study employed the GIQ developed by Cheng *et al.* [4]. The GIQ is divided into three dimensions: engagement (9 items), engrossment (7 items), and total immersion (9 items). Additionally, 10 new questions were added to assess user satisfaction with the interactive features of the IEP book, bringing the total to 35 items. Responses were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2. *Research Sample*

The research team developed an IEP book using the Unity game engine, integrating (AR), animations, gyroscopes, light sensors, and decibel sensors. The narrative focuses on the theme of adolescent depression and is presented from a third-person psychological perspective; with the aim of guiding users through a virtual story to help them better understand individuals with depression.

The story reflects the protagonist's emotional responses to various events, and users are required to utilize different interactive features to complete tasks. These interactions include AR object scanning, screen touching (Figure 1), device shaking (Figure 2), and covering light sensors (Figure 3). For instance, when the protagonist in the story is affected by negative words or sounds, users can touch the screen to remove these elements, thereby enhancing their engagement with the narrative.

Figure 1.Shows an interface icon prompting users to touch the screen to locate the protagonist.

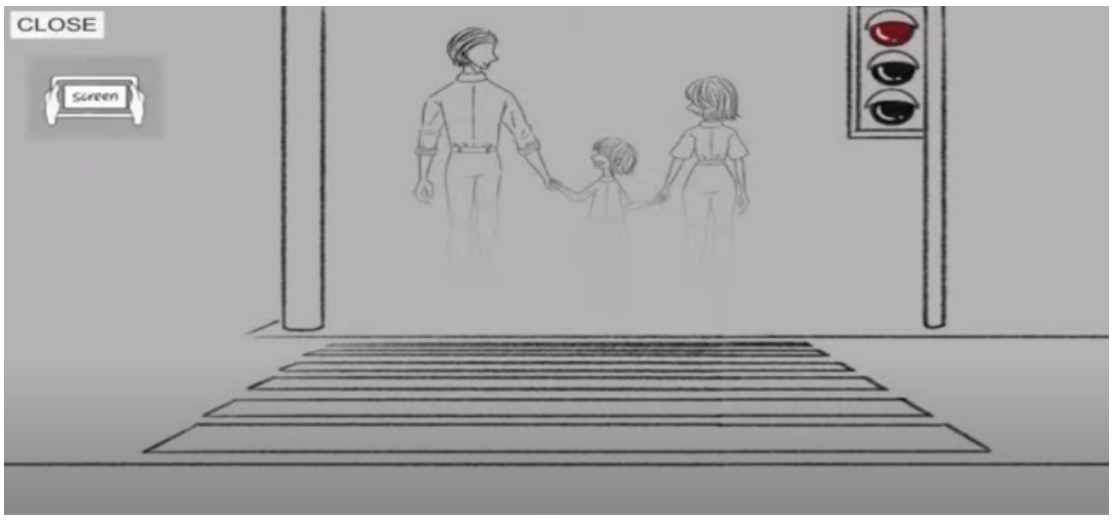

Figure 2.Displays an interface icon prompting users to shake the tablet to trigger the next part of the story.

Figure 3.Iillustrates an interface icon prompting users to cover the tablet's camera for interactive story progression.

4. Results and Findings

This section presents the statistical analysis, factor analysis, gender differences, and qualitative feedback from in-depth interviews conducted to evaluate the impact of the IEP book on users' read experiences and understanding of depression.

4.1. Descriptive Statistics

Participants for this study were recruited from various universities. Initially, 80 participants were enrolled in the study. However, four invalid questionnaires were removed, resulting in a final sample size of 76 participants. The study comprised 40 males (53%) and 36 females (47%). The respondents were aged between 18 and 37 years.

The survey results on the satisfaction with the IEP book showed an average score of 4.33 for musicality, 4.29 for interface design, and 4.28 for interactive functions.

Storytelling received an average score of 4.24, reading comprehension 4.17, and character development 4.09. Males were most satisfied with the musicality (4.40), followed by interface design (4.35), while females rated interactive functions highest (4.31), and followed by musicality (4.25). Additionally, the IEP book helped readers understand depression, with males scoring 4.13 and females 4.06. The interactive features were found to assist users in understanding the importance of being a companion, with males scoring 4.25 and females 4.08. Both genders agreed that interactive e-books could serve as supplementary healthcare tools.

In terms of satisfaction with interactive modes, AR animation ranked highest with 4.30, followed by light sensor interaction (4.25), decibel sensor interaction (4.21), and gyroscope interaction (3.92). There were no significant differences in rankings between males and females, and respondents expressed the greatest interest in the overall design of AR animations.

4.2. Factor Analysis

The study employed the GIQ scale and added 10 new questions related to user satisfaction, resulting in a total of 35 items. The reliability and validity of the questionnaire were analyzed using IBM SPSS 25. The results indicated a high internal consistency, with a Cronbach's alpha of 0.917. Exploratory factor analysis (EFA) was conducted to determine the alignment of each question within the overall questionnaire. The KMO value was 0.730, confirming the suitability for factor analysis, and Bartlett's test of sphericity was significant ($p < 0.05$). Using a scree plot, three main factors were identified and extracted via the principal axis method with promax rotation, accounting for 44.60% of the variance.

The GIQ was divided into three factors: engagement, engrossment, and total immersion. The 10 newly added satisfaction questions were all categorized under the engagement factor, indicating their alignment with positive user experiences. Question A12 I spent more time playing the game than I expected, initially classified under engagement, was found to better fit the engrossment factor based on factor analysis results. To prevent response set bias, some questions were designed in reverse, such as B10, while playing the game, I feel unhappy if someone interrupts me, B4 I often cannot hear people calling me while playing the IEP book, and B3 I am impatient when someone interrupts me when playing the IEP book.

4.3. Gender Differences

In the HEKA analysis, the results of the independent sample t-test (Table 1) revealed significant gender differences in the perception of adolescent depression in pretest question Q4 on knowledge about teenage depression $t(68.68) = 2.32$, $p = .023$, $d = -.593$. There was a significant difference between the male ($M = 1.33$, $SD = .474$) and female ($M = 1.11$, $SD = .319$) perception of adolescent depression, with females showing greater concern about the trend of depression affecting younger age groups. Q7 included positive discussions about depression, and Q8 included views about accompanying someone with depression. However, the average scores were still higher for females than males, indicating that females were more concerned about health education.

Table 1. Gender differences perspectives on HEKA

	Mean (SD)		*df*	*t*	*p*	ES (*d*)
	M(*N*=40)	F(*N*=36)				
Q4	1.33(.474)	1.11(.319)	68.68	2.32	.023*	-.539
Q7	2.78(1.165)	3.00(.956)	74	-.914	.364	.020
Q8	2.25(.809)	2.44(.909)	70.52	-.981	.330	.222

* *Significant at 5% levers. (P< 0.05)*

There was no significant difference between genders in the engagement factor of the GIQ. However, in the immersion factor, a significant gender difference was found for item B2, My ability to perceive the environment around me decreased while playing the game, with $t(74) = -2.405$, $p = .019$, $d = .546$. Females ($M = 3.50$, $SD = .737$) reported more pronounced experiences than males ($M = 3.08$, $SD = .797$). Additionally, for item B8, I often forget the passage of time while playing the game, there was a significant gender difference, $t(74) = 2.047$, $p = .044$, $d = -.473$. Males ($M = 4.03$, $SD = .80$) scored higher than females ($M = 3.67$, $SD = .717$), indicating that females immersed themselves more quickly in the IEP book, whereas males tended to be more absorbed. In the total immersion factor, a significant gender difference was observed in item C8, I used to feel that my will controlled the avatar in the game, not by the mouse or the keyboard, so the avatar did just what I wanted with $t(74) = 2.508$, $p = .014$, $d = -.579$. Males ($M = 3.45$, $SD = .714$) reported a higher degree of this experience than females ($M = 2.97$, $SD = .941$). Furthermore, in item C9, the thoughts and consciousness of the avatar and I seem connected; there was a significant gender difference, $t(74) = 2.136$, $p = .036$, $d = -.489$. Males ($M = 3.30$, $SD = .758$) reported a higher degree of connection than females ($M = 2.89$, $SD = .919$), as shown in Table 2.

Table 2. Gender differences in immersion scale: t-test results

	Mean (SD)		df	t	p	ES (d)
	M(*N*=40)	F(*N*=36)				
B2	3.08(.797)	3.50(.737)	74	-2.405	.019*	.546
B8	4.03(.80)	3.67(.717)	74	2.047	.044*	-.473
C8	3.45(.714)	2.97(.941)	74	2.508	.014*	-.579
C9	3.30(.758)	2.89(.919)	74	2.136	.036*	-.489

* *Significant at 5% levers. (P< 0.05)*

Based on the above analysis, it is evident that when engaging with an IEP book, females are more capable of quickly immersing themselves in the story context and focusing on the device or gaming experience. This suggests that females can concentrate more rapidly and feel the immersive atmosphere of the IEP book's story compared to males. However, males exhibited significantly greater immersion in the IEP book than females. The results indicate that although males take longer than females to concentrate on and engage with the IEP book, they can immerse themselves more entirely than females once they are focused on the story context. Additionally, compared to females, males tend to identify with characters' positions in the virtual world and integrate them into the context. Research has shown that males demonstrate a more pronounced degree of immersion or addiction to virtual stories than females.

4.4. Paired Sample T-Test

The analysis from the paired sample T-test (Table 3) indicated significant differences between the pre-test and post-test for questions Q1 and Q4. In Q1, there was a significant difference between the pre- and post-tests regarding depression, with $t(75) = 2.535$, $p = .013$, $d = .362$. There was a noticeable difference between the pre-test ($M = 1.09$, $SD = .291$) and post-test ($M = 1.01$, $SD = .115$). Additionally, in Q4, a significant difference was found betwen the pre- and post-test regarding teenage depression, $t(75) = 4.155$, $p = .001$, $d = .684$. The pre-test ($M = 1.22$, $SD = .419$) and post-test ($M = 1.01$, $SD = .115$) showed clear differences. However, in Q2 whether depression is considered a disease, Q7 positive discussions about depression, and Q8 views about accompanying someone with depression, no significant differences were observed between the pretest and post-test. In addition to Q1 and Q4, there were no significant differences in the other items when comparing the pre-test and post-test. Nonetheless, there was an overall improvement in the post-test knowledge assessment compared with the pre-test.

Table 3. Difference between pre-test and post-test of HEAK experiment. (N=76)

	Mean (SD)		df	t	p	ES (d)
	pre-test	post-test				
Q1	1.09(.291)	1.01(.115)	75	2.53	.013*	.362
Q2	1.21(.410)	1.24(.428)	75	-.44	.658	-.072
Q4	1.22(.419)	1.01(.115)	75	4.15	.001**	.684
Q7	2.88(1.07)	2.97(1.04)	75	-75	.226	-.085
Q8	2.33(.859)	2.43(.774)	74	-.88	.191	-.122

** Significant at 5% levers.(P< 0.05)*
*** Significant at 1% levers.(P< 0.01)*

4.5. In-Depth Interviews

Structured interviews were conducted with five participants to understand their impressions and feedback after using the IEP book, which served as qualitative data. The interviewees comprised a diverse group of two social workers (one male and one female) and one male and two female university students. The volunteer participants were between 23-30 years old and had experience reading traditional and electronic picture books. Below are summaries of the interviews with these five participants (coded A to E) regarding their experiences with the IEP book, focusing on three aspects: immersive reading experiences, feedback on interactive features, and understanding of health education information.

Regarding the immersive reading experience, Participant E noted, "*With the help of background music and story illustrations, it was easy to become immersed in the story of the IEP book, and I was satisfied with the fluency (coherence) of the story*." Participant C mentioned: "*Initially, it took some time to get used to the interactive features of the IEP book, but as familiarity increased, the reading experience became more fluid*." Participant D stated, "*The sound effects, interface, and graphic design of the story all helped me to immerse myself in the story more quickly*."

Regarding feedback on interactive features, Participant A mentioned, "*I was impressed with the blow interaction design (decibel function) and light sensor interaction in the story. These interaction methods, quite different from past experiences with electronic books, resonated well with the story context and were engaging*."

Participant B stated, "*Good interface cue symbols are essential for the IEP book; moreover, the AR animation interaction helped me better understand the feelings associated with depression*." Participant C commented, "*The interactive feature where the story's protagonist crosses the street (gyroscope function) left the deepest impression on me. The directional control during this process aligned me with the protagonist's emotions, enhancing the realism of the interaction*."

Regarding understanding health education information, Participant C said, "*I was deeply engaged with the IEP book. Integrating various interactive methods throughout the story, especially conveying positive support towards the end, was touching. The story's portrayal of accompanying a person with depression helped me to understand better and learn to view individuals with depression in a positive light*." Participant E commented, "*Through the psychological journey of the story's protagonist, my understanding of the feelings of people with depression was enhanced; it also gave me a deeper empathy towards similar issues in social news*."

The overall results of the interviews indicated that interactive features and sound effects helped enhance users' immersive reading experiences. The IEP book effectively promoted health education objectives, facilitated the understanding of depression, and increased the users' interest in reading.

5. Discussion

This study explores users' immersive reading experiences with the IEP book and its cognitive effectiveness in mental health education, focusing on two primary research questions, informed by the findings: (1) the effect of IEP books on immersive reading experiences across different genders and (2) the feasibility of using IEP books for health education.

Gender differences in cognitive awareness of mental health were identified in this study. Numerous prior studies have highlighted these differences, including variations in emotional sensitivity [34], [35], cognitive styles, and performance outcomes between genders [36], [37]. These findings align with the results of this study, demonstrating that females tend to be more sensitive to adolescent depression symptoms.

Females exhibited greater concern for mental health issues and showed a higher ability to recognize emotional and psychological states in themselves and others. This sensitivity was also reflected in the higher pre-test HEKA scores among females compared to males. Immersion is often considered a precursor to reaching the optimal flow state, which is a highly engaged and focused state of mind [38], [39]. Significant gender differences were noted in the immersion process, with males demonstrating deeper immersion, particularly in terms of losing track of time during engagement in the virtual environment. Males identified more strongly with virtual characters and were more immersed in the virtual scenarios than females.

Flow, a state of deep focus and complete absorption, is characterized by eight stages: a balance between challenge and skills, focused attention, clear goals, immediate feedback, a sense of control, immersion, loss of time perception, and a disappearance of self-consciousness [40]. These stages are key to understanding how immersive experiences enhance learning and engagement.

The IEP book's design, including its story, interactive elements, interface aesthetics, and music, plays a crucial role in fostering immersion [41]. Appropriate interactive features enhance immersion by integrating interactive technology into the narrative, aligning with the three dimensions of immersion: absorption, enjoyment, and intrinsic interest [9]. The visual elements in the IEP book were particularly effective in generating attention and motivation, enhancing deep participation. While some research suggests that immersive engagement in science games may negatively impact cognitive learning outcomes [4], this study found that the IEP book supported deep learning in a more empathetic and emotional context, fostering health knowledge about depression rather than purely cognitive scientific learning.

Interviews with users provided insights into their experiences during immersive reading, including feedback on interactive design and their understanding of health education. Despite the limited sample size, the evaluation results indicated that the IEP book was well-received by users.

The COVID-19 pandemic has significantly increased public awareness of health education and highlighted the importance of mental health education. The results of this study indicate that the IEP book effectively enhances users' understanding of health education, with a notable improvement in cognitive performance, especially among male participants. This improvement may be attributed to males' greater emotional engagement with virtual themes and story characters, fostering a stronger sense of empathy.

In the context of mental health education, providing patients and their families with knowledge about emotional support and maintaining interactive connections can be highly beneficial, particularly in remote settings [42], [43]. The theory of positive psychology further supports the findings of this study, suggesting that maintaining a positive mental flow state helps stabilize emotions. Individuals who remain in a state of flow for extended periods are more likely to experience positive conscious engagement, leading to enhanced well-being and overall quality of life [44]. Therefore, the use of remote digital tools as intermediaries in mental health education shows considerable promise.

This research builds on the empirical studies conducted by Brown and Cairns [15] and Cheng *et al.* [4] on game immersion. The interactive design of the IEP book, with its gamified elements, motivates users to achieve specific goals while enjoying the process [45], [46], [47]. The U.S. Food and Drug Administration (FDA) has approved Akili Interactive's EndeavorRX game for the treatment of Attention Deficit Hyperactivity Disorder (ADHD) [45]. This game, based on neuroscience research, employs interactive technology to help children improve attention and focus. Similarly, the findings of this study support the use of digital tools as supplementary aids in healthcare. The IEP book integrates multiple sensory modalities, including static and dynamic visuals, auditory, tactile, and emotional elements, which enhance the reading experience [48]. By embedding health education into the narrative, the gamified interactivity of the IEP book increases readers' interest and intrinsic motivation.

The immersive reading approach of the IEP book has been demonstrated to improve users' attention to mental health education. This outcome aligns with the study's objectives, reflecting increased user awareness of adolescent depression and the importance of companionship.

Study Limitations and Future Directions: This study has several limitations that warrant further exploration. First, the sample size was relatively small due to time constraints and variations in individual reading durations. The complexity of the testing process, which included pre-tests, reading sessions, post-tests, and interviews, further limited the number of participants. Second, participants were primarily recruited from universities, resulting in a sample group that was predominantly young. Future research should explore the applicability of IEP books across a broader range of demographic groups. Finally, the research sample used for testing was developed specifically for iOS devices.

Given the wide variety of digital reading platforms, future studies should expand to other platforms to explore potential adjustments or modifications for broader applicability..

6. Conclusion

This study introduced an integrated experiential reading model into the IEP book through game-like immersive experiences. Understanding the relationship between user immersion experiences and health education cognition (empathy) is becoming increasingly important. The research, which considered interactive books' multisensory and gamified technology interactions, provides empirical evidence to demonstrate the effectiveness and benefits of the IEP book in establishing mental health education cognition. Through an experimental research design, there is further understanding of the impact of different levels of immersion on users of different genders, particularly males. Males scored higher than females in the stages of engrossment and total immersion experience during the reading process and level of empathy. This study confirms the correlation between users' immersive experiences and empathetic understanding. Combining interactive technology with knowledge transfer brings new possibilities to education.

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