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Transforming Education and Cognitive Behaviors through the Metaverse: A Systematic Literature Review and Innovative Analysis

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Abstract

The metaverse, an emerging technology characterized by interactive and simulated environments, presents a transformative opportunity to reshape learning processes, beliefs, and cognitive behaviors. This paper investigates the impact of the metaverse on education and mental habits through a systematic literature review and empirical data analysis. A comprehensive review of 50 scientific articles published between 2007 and 2024 was conducted, complemented by a survey questionnaire distributed to 100 participants. The literature review highlights that the metaverse enhances learning experiences by offering immersive, experiential, and personalized environments, while also influencing users' beliefs and fostering new cognitive patterns. However, challenges such as digital dependency, infrastructure costs, and ethical and privacy concerns must be addressed. Quantitative findings indicate that the metaverse boosts learners' motivation, focus, and self-confidence. Qualitative analysis reveals four key themes: increased focus, enhanced self-confidence, technical challenges, and security concerns. The results suggest that the metaverse not only enriches learning but also facilitates changes in mental habits. Notably, this study is limited in its assessment of the long-term effects of metaverse use on real-world focus due to constraints in controlling usage duration, which may potentially explain discrepancies with studies reporting adverse effects of prolonged engagement. By identifying opportunities and challenges in educational applications of the metaverse, this paper provides actionable recommendations for its effective integration into educational systems.

Keywords: Metaverse, Learning processes, Cognitive behaviors.

1 | Introduction

This paper is situated within the framework of the emerging field of Cognitive-behavioral immersive learning, which utilizes a combination of cognitive science, behavioral psychology, and immersive technologies such

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as the metaverse to examine changes in mental habits [1]. We examine the impact of the metaverse on two primary dimensions of this field, including the cognitive dimension (enhancing learners' concentration, memory, and self-efficacy) and the behavioral dimension (altering mental habits and interaction patterns in virtual environments).

In the digital age, technologies such as the metaverse are redefining traditional concepts of teaching and learning [2]. As a virtual, interactive, and multisensory environment, the metaverse provides unprecedented opportunities for personalized education, experiential learning, and the development of social skills. By simulating real-life situations, these spaces allow for the practice, experience, and analysis of mental behaviors in a safe and interactive context.

Along with these potentials, there are also challenges, including digital dependency, ethical issues, security concerns, and infrastructure limitations. On the other hand, the psychological effects of the metaverse on concentration, memory, self-confidence, and mental habits are an area that still needs more comprehensive research [3].

The purpose of this article is to comprehensively examine the impact of the metaverse on the learning processes, mental habits, and cognitive beliefs of users. In this regard, the present study, with a mixed approach (review and empirical), has analyzed both the content of international scientific research and examined the empirical data obtained from the questionnaire.

The article tries to answer these questions:

I. How can the metaverse improve the quality of learning and the mental engagement of learners?

II. What changes occur in the mental habits, focus, and motivation of users as a result of the metaverse experience?

III. What are the key challenges and opportunities of using the metaverse in education?

IV. How can the metaverse be used as a tool to rewrite beliefs and cognitive patterns?

2 | Metaverse and Education

2.1 | Definition of Metaverse

A metaverse is a digital and virtual world in which users can interact, learn, and gain new experiences through their avatars [4]. This simulated environment is created through a combination of Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI). It provides an interactive and multisensory platform for social, educational, and recreational activities.

2.2 | Metaverse as a Platform for Innovation and Transformation

The metaverse can bring about significant changes in educational systems. In these virtual spaces, individuals can connect with others through their avatars and engage in deep learning experiences that transcend physical limitations. Education in the metaverse provides opportunities for learning in interactive and engaging environments. In the metaverse, simulated environments can be created for practical training and workshops that extend the learning experience beyond traditional methods.

2.3 | Properties of the Metaverse in Education

2.3.1 | Interactive and group learning

Students can interact in group environments such as virtual classes or science projects. Traditional educational methods often rely on passive learning, where students receive information without active interaction. In contrast, the metaverse actively engages users in simulated environments, creating experiential and collaborative learning opportunities [5]. For example, instead of simply studying World War I, students can experience a 3D simulation of the war, gaining a deeper understanding of history.

2.3.2 | Multisensory interaction and immersive experience

The use of VR and AR technologies transforms learning into a multidimensional experience that engages multiple senses simultaneously [6]. By integrating visual, auditory, and even haptic feedback, these technologies create an immersive environment that closely mimics real-world interactions, enabling learners to experience scenarios that would otherwise be inaccessible or impractical in traditional educational settings. For instance, VR can simulate historical events, scientific experiments, or complex engineering systems, allowing users to explore and interact with content in ways that deepen understanding and retention. Similarly, AR overlays digital information onto the physical world, enhancing contextual learning by bridging the gap between abstract concepts and tangible experiences [7].

2.3.3 | Simulated training

One of the most significant benefits of the metaverse is the ability to engage in interactive simulations, which enable learners to practice complex skills in environments that are hazardous or challenging in the real world. Examples of this type of training include: chemical experiments in a virtual environment without the dangers of real chemicals, flight simulation for pilot students, medical and surgical training for medical students, crisis management in emergencies, and other emergencies. Research indicates that the use of VR technologies in educational settings enhances student engagement and learning [8].

2.3.4 | Reducing geographical and economic barriers

One of the challenges of traditional education systems is geographical and economic limitations. The metaverse can eliminate these barriers. For example, many people around the world may not have access to prestigious universities or quality educational opportunities. But in the metaverse, anyone with an internet connection can participate in authentic educational classes. Studies have shown that the metaverse can provide access to quality education for people living in disadvantaged areas [9].

2.3.5 | Personalized learning

The metaverse enables personalized learning experiences, allowing learning environments to be tailored to the specific needs of each student. AI-based algorithms can analyze student progress and tailor lessons to their learning style. Studies have shown that AI-based learning platforms in the metaverse enhance learning outcomes [10]. In traditional classrooms, all students must learn at the same pace and in the same way; however, in the metaverse, learners can progress at their own pace and according to their interests, which increases their motivation and engagement in the learning process.

2.3.6 | Strengthening social skills through avatars

Interaction in metaverse environments can significantly strengthen the communication and social skills of both children and adults by providing a unique platform for interaction through avatars. Avatars, as digital representations of users, enable individuals to engage in social interactions that transcend physical limitations, fostering collaboration, empathy, and self-expression in virtual spaces. These interactions often encourage users to adapt their communication styles, practice active listening, and develop confidence in expressing themselves, particularly in scenarios where anonymity or customizable identities reduce social anxiety [11].

2.3.7 | Social learning

In the metaverse, people can participate in classes, seminars, and workshops simultaneously. Students can participate in interactive virtual classes, ask questions, and solve complex problems in groups. Research has shown that social learning in the metaverse can improve students' communication and collaboration skills [12].

2.3.8 | Game-based learning

Another transformative aspect of the metaverse in education is game-based learning. Educational games in the metaverse enable students to learn new concepts in an interactive and fun way. Research has shown that educational games can enhance student engagement and improve learning effectiveness [13].

2.3.9 | Visualization

The metaverse can help learners see things that were previously difficult to see in the real world, such as molecules or biological cells [14]. It can also simulate ideal conditions in physics and make abstract theories tangible, for example, Einstein's theory of relativity. This type of learning can also strengthen critical thinking and problem-solving skills in students.

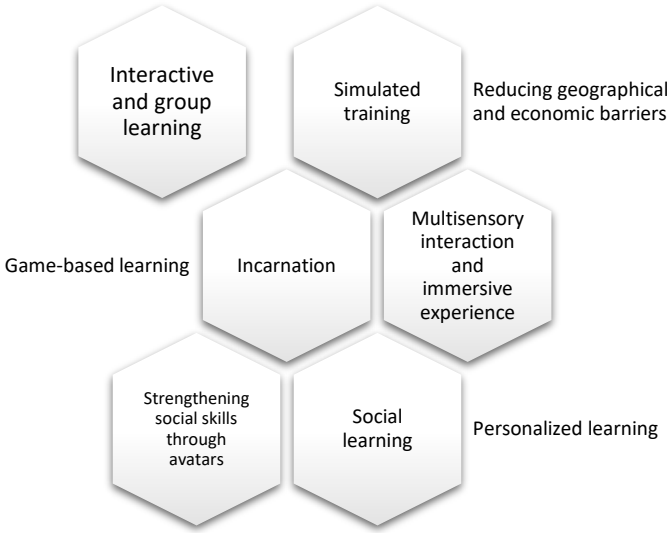

Fig. 1. Features of the metaverse in education.

2.4 | The Future of Metaverse in Education

2.4.1 | Integration with emerging technologies

In the future, AI, Machine Learning (ML), and blockchain technologies could find new applications in the metaverse and educational systems simultaneously. For example, AI could help create intelligent courses that are tailored to the behavior and needs of the learner.

2.4.2 | Global education and universal access

The metaverse could be a tool for creating global education and enabling access to educational content from around the world. This opportunity is particularly significant for students residing in remote areas or those with limited access to academic resources. According to the UNESCO (2024) report [15], integrating the metaverse into educational systems requires investment in affordable infrastructure and training educators.

3 | The Role of the Metaverse in Changing Mental Habits and Rewriting Cognitive Patterns

3.1 | The Impact of the Metaverse on Memory and Mind

The metaverse can change the functioning of memory and mind through simulated environments and interactive experiences [16]. These effects include:

I. Working memory and long-term memory: multisensory experiences in the metaverse can enhance working memory and consolidate information in long-term memory.

II. Emotional connection to learning: immersive experiences in the metaverse create a stronger emotional connection to learning, which makes information better retained in memory.

3.2 | The Concept of Mental Habits and their Impact on Life

Mental habits are a set of unconscious thoughts and behavioral patterns that affect decision-making, emotional reactions, and overall performance of individuals. In the book [17] it is emphasized that every thought that is formed in our mind has a direct impact on the body and vice versa. Habits are reinforced through neural pathways, and in order to change them, new pathways need to be created in the brain. The subconscious mind can accept changes and, with conscious practice, release negative habits and replace them with positive habits. One of the most essential methods for changing habits is visualization. By visualizing yourself performing a new behavior, the brain processes it as a real experience and forms new neural pathways for it. This technique is most effective when combined with positive emotions and a belief in success.

3.3 | The Role of the Metaverse in Changing Mental Habits

The metaverse, within the framework of cognitive-behavioral immersive learning, as defined by Yuan et al. [18], demonstrates that it can induce lasting changes in mental habits by activating multisensory neural pathways.

3.3.1 | Experiencing and simulating new behaviors

The use of VR and AR in the metaverse enables users to experience different situations and break old habits, practicing new behaviors. For example, a person who is afraid of public speaking can be in the same problem over and over again in the metaverse environment and strengthen their skills by reducing anxiety.

3.3.2 | Reward and positive reinforcement

The metaverse employs immediate reward systems to encourage positive habit formation. By offering points, badges, or virtual incentives for completing tasks or exhibiting desired behaviors, it boosts user motivation and engagement. This instant feedback reinforces neural pathways associated with the repetition of those behaviors. For example, children can be rewarded for academic achievements, fostering a sense of accomplishment. Such systems create a structured environment that promotes sustained behavioral change over time.

3.3.3 | Stress management and related habit changes

The metaverse provides immersive environments where users can practice stress management techniques, including meditation and breathing exercises. Simulated settings, such as tranquil natural landscapes, enhance relaxation and mindfulness training. These activities help users develop coping mechanisms for real-world stressors. Regular practice in the metaverse can lead to improved emotional regulation and reduced anxiety. The personalized nature of these simulations ensures that they are adaptable to individual needs.

3.3.4 | Mental programming to create new habits

In the metaverse, users can design virtual routines to establish new habits effectively. For instance, someone aiming to improve time management can simulate daily schedules and practice adhering to them. The immersive nature of the metaverse reinforces these routines through repetition and consistency, thereby solidifying them. Over time, virtual practices translate into real-world behavioral changes. This approach allows individuals to experiment with habit-building strategies in a controlled and engaging environment.

3.3.5 | Anger management and negative emotions

The metaverse provides simulations to help users constructively manage anger and negative emotions. Children and adults can practice responding to stressful scenarios in a safe, virtual space. Through role-playing

and guided interventions, they learn techniques to manage their emotions effectively. For example, a child might engage in a simulation that teaches calming strategies during conflicts. These experiences build resilience and improve interpersonal interactions in real-life situations.

3.3.6 | Improving concentration and reducing distractions

The metaverse designs games and activities that require sustained focus, helping users enhance their concentration skills. Tasks that demand attention to detail or prolonged engagement train the brain to minimize distractions. For example, puzzle-solving or strategy-based games can improve cognitive endurance. These activities are particularly beneficial for children and adults struggling with focus-related challenges. By practicing in immersive environments, users develop better attention spans applicable to real-world tasks.

3.3.7 | Managing fears and phobias

The metaverse can provide environments for gradual exposure to fears. For example, someone who is afraid of heights can be gradually exposed to heights in a controlled manner in virtual environments to reduce this fear. Additionally, individuals who are scared of public speaking can practice in metaverse simulations to boost their self-confidence.

3.3.8 | Reinforcing healthy habits

Metaverse programs can incorporate reward systems that incentivize positive activities, such as regular exercise, improved concentration, or effective time management. By offering virtual rewards, like points, badges, or exclusive content, these programs encourage users to adopt healthier behaviors. The engaging and interactive nature of the metaverse makes the process of habit formation enjoyable and motivating. Over time, this approach enables individuals to replace negative habits with constructive ones, promoting long-term personal growth and well-being.

3.4 | Successful Examples of Changing Habits Using the Metaverse

The metaverse has demonstrated its potential to drive behavioral and cognitive transformations through innovative programs and immersive experiences. These examples illustrate how virtual environments can be utilized to promote positive changes in habits and mindsets.

3.4.1 | Bravemind program

Bravemind is a groundbreaking VR-based therapy program designed to alleviate symptoms of Post-Traumatic Stress Disorder (PTSD) in soldiers and trauma patients [19]. By immersing patients in carefully constructed simulated environments, the program allows them to gradually confront and process traumatic memories in a controlled and safe setting. This exposure therapy approach has been shown to reduce anxiety, disrupt negative thought patterns, and promote emotional healing. Research indicates that Bravemind not only improves mental health outcomes but also empowers patients to regain control over their lives by replacing fear-based responses with resilience and adaptive coping strategies.

3.4.2 | Game-based learning systems

Game-based learning systems within the metaverse have revolutionized education by making learning more engaging and interactive. Studies show that students using metaverse-based educational games to solve math or science problems exhibit higher levels of motivation, focus, and critical thinking. These games often incorporate rewards, challenges, and collaborative elements that encourage active participation and problem-solving. For instance, students who solve puzzles or complete quests in virtual environments develop perseverance and analytical skills. By merging entertainment with education, game-based systems in the metaverse not only enhance academic performance but also cultivate lifelong learning habits.

4 | Research Method

This article employs a combined approach (systematic literature review and experimental research) to investigate the impact of the metaverse on education and mental health. The methodological steps are as follows:

To review the relevant literature, Scopus, Web of Science (WoS), and Google Scholar databases were selected and analyzed with keywords such as "Metaverse and education", "Mental habits in metaverse", and "VR-based learning" including articles published between 2007 and 2024 and experimental, analytical, or review studies with quantitative/qualitative data as well as articles related to education, cognitive psychology, and technology and non-English/Persian articles and studies without citation data were also excluded.

From an initial pool of 150 identified articles, duplicates and irrelevant items were removed, leaving 50 articles selected based on predefined criteria. A content analysis was performed using thematic coding, and the findings were organized into four main themes: interactive learning, changing mental habits, technical challenges, and ethical issues. To complement the literature review, empirical research was conducted through a questionnaire distributed to 100 participants (60% female, 40% male) aged 21–41 years. Participants were selected based on their experience, requiring at least six months of engagement with metaverse platforms such as Horizon Worlds or VRChat, and involvement in educational or social activities within the metaverse. The composite questionnaire included 10 closed-ended questions measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) and four open-ended questions to gather qualitative insights. Quantitative data were analyzed using SPSS software, employing descriptive statistics such as mean, standard deviation, and percentages. In contrast, qualitative data underwent thematic analysis, utilizing open and axial coding, which resulted in the extraction of four key themes.

The study ensured internal validity by using reliable sources from Scopus and WoS and conducting a systematic screening process. The reliability of the questionnaire was assessed using the Cronbach's alpha test, yielding a satisfactory score of α=0.82, indicating strong internal consistency. External validity was addressed by emphasizing the generalizability of the results to broader contexts; however, certain limitations were acknowledged, including the relatively small sample size and potential for voluntary bias due to participant self-selection. These factors highlight the need for cautious interpretation and further research to validate the findings on a larger scale.

5 | Quantitative Results

The results of the quantitative data analysis showed that participants had a positive experience of learning in the metaverse environment. The overall mean scores for the 10 main questions were 4.09 out of 5, indicating high satisfaction with learning in the metaverse. The results of this study show that the metaverse can increase motivation and focus in the short term; however, managing the duration of use is necessary to avoid long-term adverse effects.

The highest scores belonged to the following questions:

I. Increased interest in learning (mean: 4.3).

II. Increased confidence in one's own abilities (mean: 4.2).

III. Developing a positive attitude towards oneself (mean: 4.2).

Table 1. The mean, standard deviation, and percentage of agreement for each question.

Percentage of Responses Agreeing or Strongly Agreeing	Standard Deviation	Average Score	Question
85%	0.6	4.3	Increased interest in learning
80%	0.7	4.1	More enjoyable than traditional methods
78%	0.8	4	Improve the speed of memorizing content
75%	0.9	3.9	Improve problem-solving skills
83%	0.6	4.2	Increase positive self-esteem
81%	0.7	4.1	Develop positive learning habits.
78%	0.8	4	Improve communication skills
73%	0.9	3.8	Improve teamwork
84%	0.6	4.2	Increase confidence in the ability to overcome challenges.
79%	0.7	4	Increase intellectual flexibility

6 | Qualitative Results

The qualitative data obtained from the open-ended questionnaires were analyzed using thematic analysis [20] and the following steps:

I. Open coding: responses were reviewed line by line, and initial codes were extracted.

II. Axial coding: similar codes were grouped into conceptual categories (e.g., "increased focus" or "security concerns")

III. Validation: two independent researchers performed the coding process, and inter-coder reliability was calculated with a Cohen's kappa coefficient of 0.85. To ensure the validity of the qualitative analysis, triangulation strategies were used:

IV. Data triangulation: comparing qualitative responses with quantitative results (e.g., a score of 4.2 in self-confidence).

V. Member checking: a summary of the themes was sent to 10 participants, and final approval was obtained.

VI. Use of qualitative software: coding was done in MAXQDA software to reduce researcher bias.

The validity of the findings was confirmed through triangulation of quantitative and qualitative data, as well as a review by three experts.

Extraction of final themes: 4 main themes were determined by consensus of the researchers. These themes were confirmed by at least 10% of the participants (4 people per theme).

I. Increasing focus on learning (30 people).

II. Strengthening self-confidence (28 people).

III. Technical challenges, such as poor internet (18 people).

IV. Concerns about privacy (12 people).

Table 2. Qualitative analysis of themes and participant responses.

Education	Gender	Age	Theme	Sample Quote
Bachelor's degree	Woman	32	Increased concentration	In the metaverse, unlike in a real classroom, I don't have classmates to distract me.
Bachelor's degree	Man	28		The immersive experience allows me to focus all my attention on the lesson.
Bachelor's degree	Man	25		Removing physical stimuli in the metaverse made learning easier for me.
Master's degree	Woman	40	Technical challenges	Poor internet in our city makes the metaverse environment easily disconnected
Master's degree	Man	35		Lack of access to quality headsets limited my experience.

It is important to note that although the results of this study showed that metaverses improve users' concentration in the virtual environment (mean: 4.3), recent studies, such as Chen et al. [21], have demonstrated that metaverses improve users ' concentration in the virtual environment. They warn that use for more than 2 hours per day may lead to decreased attention in the real world. This discrepancy is likely due to differences in duration of use and type of activities. According to cognitive load theory [22], immersive environments are effective in the short term by eliminating external stimuli; however, excessive use can lead to mental fatigue. It is recommended that future studies investigate the effect of time variables using a longitudinal design.

Table 3. The details of the themes and related quotes.

Theme	The Number of People Who Mentioned	Sample Quote
Increased concentration	30	I was able to focus on my studies better in the metaverse.
Boosting self-confidence	28	I felt more capable of solving problems.
Technical challenges	18	Poor internet quality sometimes hindered my learning.
Privacy	12	I wasn't sure how secure my information was in the metaverse.

7 | Conclusions and Recommendations

The metaverse has emerged as a transformative platform with the potential to revolutionize education and reshape mental habits, offering immersive, interactive, and personalized learning experiences that enhance focus, motivation, and cognitive development. As demonstrated in this study, the metaverse serves not only as an advanced educational tool but also as a dynamic cognitive-behavioral laboratory capable of fostering personal growth and social transformation. However, realizing its full potential requires addressing significant challenges, including technical limitations, psychological risks such as digital dependency and a reduced focus on real-world activities, and ethical concerns like data privacy and security. To ensure equitable access and sustainable integration, interdisciplinary collaboration among educators, technologists, and policymakers is essential, alongside further research into long-term effects and optimal usage conditions. By adopting blended learning models, establishing robust legal frameworks, and designing inclusive, cost-effective solutions, the metaverse can be leveraged to drive meaningful change in education and beyond, ultimately contributing to a more innovative and inclusive future.

7.1 | Challenges and Limitations

While the metaverse holds immense potential to transform education and reshape cognitive patterns, its implementation is accompanied by significant challenges that must be carefully addressed. These challenges can be grouped into four main categories: technical and infrastructure challenges, such as high costs of equipment (e.g., VR headsets and high-speed internet), which are often unaffordable for disadvantaged areas, along with issues like latency, motion sickness, and reliance on stable internet access; psychological and social challenges, including risks of digital addiction, social isolation, and the "Proteus effect," where users adopt avatar traits in the real world, potentially distorting self-concept, as well as reduced focus in physical tasks due to excessive immersion; ethical and privacy challenges, such as sensitive data leakage, inadequate legal frameworks for issues like digital asset ownership or misconduct, and risks of educational fraud or manipulation within virtual environments; and academic challenges and cultural acceptance, including resistance to change among traditional educators, a lack of high-quality educational content, and the digital divide, which threatens to exacerbate inequalities in access to technology and educational opportunities. Addressing these multifaceted challenges is crucial to ensuring equitable and effective integration of the metaverse into education and society.

7.2 | Suggestions for Future Research and Educational Policymaking

To optimize the use of the metaverse in education while mitigating its potential risks, several key recommendations are proposed. First, the development of blended learning models that integrate metaverse technologies with traditional educational methods can create hybrid systems, combining the strengths of both physical and virtual environments to address existing challenges. Furthermore, future research should investigate the long-term cognitive, psychological, and behavioral effects of metaverse use, with a focus on interdisciplinary collaboration across fields such as cognitive science, psychology, neuroscience, and information technology. This is particularly important given the contradictions in current literature, such as the adverse effects of prolonged metaverse engagement, which highlight the need to identify optimal usage conditions. Clear legal frameworks must also be established to protect user privacy and security, with technology companies providing transparent policies for data collection and usage. To ensure equitable access, governments and international organizations should invest in digital infrastructure for underserved areas, exploring cost-effective alternatives like AR to reduce reliance on expensive VR equipment. Furthermore, teacher training programs should be developed to equip educators with the skills needed to effectively utilize metaverse platforms, incorporating virtual teaching competencies into teacher education curricula. Inspired by UNESCO's 2024 strategies, policymakers should prioritize equitable access to metaverse technologies, ensuring that disadvantaged communities are not left behind in this evolving educational landscape.

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Data Availability

All data are included in the text.

Conflict of Interest

The authors declare no conflict of interest.

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