



## Review article

# Sociodigital experiences and creativity in the metaverse: An integrative review

Ingrid Weingärtner Reis<sup>a,b,\*</sup>, Artieres Estevão Romeiro<sup>a</sup>, Carlos Henrique Berg<sup>b</sup>,  
Vania Ribas Ulbricht<sup>b</sup>

<sup>a</sup> Universidad Técnica Particular de Loja, Loja, Ecuador

<sup>b</sup> Universidade Federal de Santa Catarina, Florianópolis, Brazil

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## ABSTRACT

Access to sociodigital experiences is constantly expanding, driven by the development of immersive technologies that capture the public's interest. These technological advances present a hypnotic nature, sparking curiosity, creating new experiences, and providing opportunities for expanding access and inclusion. This article aims to highlight the characteristics and requirements necessary for the development of creativity in new virtual environments, with a focus on the metaverse, a three-dimensional and interactive virtual space that offers users the sensation of existence within this environment. The study centers on the following question: what are the essential characteristics for an immersive environment to promote the development of creativity in its users? Understanding how technologies influence creativity is crucial to driving innovation, the progress of contemporary sciences, and education. This research analyzed various approaches and strategies for the use of the metaverse and immersive virtual environments to promote user creativity. Through an integrative literature review, practical characteristics that contribute to creativity in previous studies were identified. The results highlight the presence of common characteristics, organized into a model of articulation of the sociodigital analysis categories for creativity with potential for application.

## 1. Introduction

Creativity is a fascinating topic that piques the interest of various fields of knowledge. The ability to generate innovative solutions, think outside stereotypical patterns, and generate original ideas is essential for human development and for addressing the challenges of contemporary society [1]. Although it is a valued skill in different domains such as the arts, science, technology, and business, there are still many questions about what creativity is, the biological and psychological mechanisms it operates on, its determining factors, and how it can be stimulated.

In this context [2], theses on how the medium becomes the message and on technological determinism in societal development demand a profound reflection on how new sociodigital experiences in the metaverse can enhance or diminish human creativity. As emphasized by Ref. [1], creativity is often related to a mental state of 'flow', in which a person is fully immersed and focused on a challenging activity. This underscores the complexity of creativity and the importance of creating environments that encourage this

\* Corresponding author. Universidad Técnica Particular de Loja, Loja, Ecuador.

E-mail addresses: [ingridweis@gmail.com](mailto:ingridweis@gmail.com), [iwreis@utpl.edu.ec](mailto:iwreis@utpl.edu.ec) (I. Weingärtner Reis), [artieres@gmail.com](mailto:artieres@gmail.com), [aeromeiro@utpl.edu.ec](mailto:aeromeiro@utpl.edu.ec) (A. Estevão Romeiro), [chbplan@gmail.com](mailto:chbplan@gmail.com) (C. Henrique Berg), [vrulbricht@gmail.com](mailto:vrulbricht@gmail.com) (V. Ribas Ulbricht).

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type of deep engagement. Information and communication technologies represent an opportunity for the development of collaborative spaces where people can act creatively and freely, regardless of embodiment or synchrony of actions, but they can also be spaces of simplistic, fragmented, and stereotyped thinking.

According to Ref. [3], the metaverse is a vast network of 3D virtual worlds where many people can be present simultaneously with their own identities and persistent information such as history, objects, communications, and payments. Also, as noted by Ref. [4], the services offered by the metaverse, or ‘metaverse services,’ are a collective term for the application of augmented reality, lifelogging, mirrored worlds, and virtual worlds. With the advancement of technology, the metaverse becomes part of people’s daily lives in various levels and situations and becomes a possibility for stimulating and promoting creativity [4]. Technologies have been rapidly integrated into people’s lives, becoming practically ubiquitous and inseparable from every step humanity takes [5].

This article aims to present an integrative literature review on the use of creativity in metaverse experiences, identifying the characteristics used to stimulate users’ creativity and their outcomes. Through this analysis, we seek to identify the main possibilities of sociodigital networks and the metaverse as an educational environment. The research results contribute to understanding how immersive virtual environments can be used as a tool to enhance creativity and innovation in their users.

### 1.1. Creativity

Creativity is a highly sought-after skill in the job market and holds great importance in the development of societies. It enables individuals to find innovative solutions to everyday challenges and develop new forms of expression and the creation of unique products and services. It can also help solve real-life problems through these discoveries. While creativity is often associated with creative fields, it can be applied and cultivated in any sector of human activity [6,7,8,9].

Our understanding of creativity has evolved throughout history. Initially, it was perceived as something almost spiritual, a gift bestowed upon a few individuals. However, it has transitioned into a more rational and scientific perspective, where it can be studied, understood, and applied in various aspects of life [10].

According to Ref. [11], creativity is recognized as the ability to solve problems and create products that are significant or can bring about changes in a specific context. For [12], creativity is defined as the ability to generate solutions that are innovative and appropriate, thus creating new knowledge in the minds of individuals. As for [9], they emphasize that creativity is a skill, not just an innate talent, and it is essential that individuals use their skills and stimulate this ability through group idea generation techniques.

The authors [13] argue that creativity is not limited to a specific domain, as creation is present in all domains, representing the phenomenon of knowledge generation. According [14] views, creativity not as a “gift” or something mystical but as a cognitive structure that can be nurtured and challenged, resulting in new and original ideas as well as new perceptions of the world. In this way, creative insight provides openness to new experiences and a broader view of the world.

Some key aspects highlighted in these concepts are that creativity is a process identified in humans, it is related to problem-solving or change, and it is inherently contextual [7]. takes the contextual aspect further, asserting that creativity is a systemic process rather than an individual one, emphasizing the importance of context, environment, and spatial dimensions in which an individual is situated.

For [6], the importance of collaborative creative work is highlighted, which can be more intelligent than individuals working in isolation. Thus, teamwork is considered key to unlocking creativity. In this level of collaboration, involving teamwork and the relationship with the context, environmental and social aspects become relevant and emphasize the need for an intentional environment for creativity.

In his studies [6], mentions some characteristics that this environment should have, including the possibility of dialogue, social interaction, an environment conducive to experimentation without fear of making mistakes and where people can explore their abilities. Additionally, creative spaces for brainstorming and projection should be spacious, allowing simultaneous visibility of materials such as prototypes, storyboards, and images, facilitating pattern identification and creative synthesis. Furthermore, the use of digital media and technological resources such as websites, applications, wikis, and various types of artificial intelligence can keep participants connected, even if they are physically located elsewhere [15].

This curiosity or interest in technological aspects can be considered to have one of its origins in robotics applied as a teaching resource, or in the use of techniques where students assemble, automate and control mechanical devices [10]. It is also possible to identify the Problem Based Learning (PBL) technique as a powerful tool for developing creativity by focusing on the student’s participation as a key player in solving the problem or phenomena proposed [10].

Lateral thinking, an important concept introduced by Ref. [8] in the search for creativity, contrasts with linear thinking, considered a predictable type of thinking in which ideas are developed or presented within a logical and predictable structure. Lateral thinking, on the other hand, involves exploring different perspectives, breaking patterns, and challenging conventional responses. It can be understood as a mode of thinking characterized by the presence and production of new and original ideas not previously known to by the individual or their group [16]. Lateral thinking is characterized by fluency, flexibility, originality, elaboration, and sensitivity to problems [14].

In summary, creativity and lateral thinking are essential skills for generating creative solutions in various fields of endeavor.

Understanding the nature of creativity and how to stimulate it can be crucial for the development of new ideas and solutions to complex problems. However, it is an essential element in the context of sociodigital relationships and educommunication. Therefore, there is a clear need to create an environment conducive to fostering creativity, one that enables teamwork, the use of appropriate tools, and the exploration of different perspectives and skills, both in the real world and in virtual realms.

## 1.2. Metaverse

The hypnotic nature of the media is highlighted by Ref. [17], pointing out that each technological innovation alters our consciousness and psychic universe, taking some of our biological capacities beyond natural human capabilities. The concept of the metaverse corroborates this thesis; it is a virtual, three-dimensional, and interactive space that can be accessed through technologies like virtual and augmented reality, providing a sense of presence and mirroring real-world actions [4]. In this environment, users can interact with other people, objects, environments, and experiences in an immersive and collaborative manner. For [3], the metaverse is “a vast network of 3D virtual worlds where many people coexist simultaneously, each with their own identities and information that persists according to their actions and interactions”.

According to Ref. [18], the metaverse is “an unlimited virtual area where you can meet people in virtual reality (images, objects, places, and sounds produced by a computer that appear to represent a real place or situation)”. According to the authors, the concept of the metaverse can mean replicating a person’s life, interests, routines, and relationships in the digital universe. The metaverse can also be defined as a virtual world in which the user’s avatar or alter ego acts and becomes active in the virtual environment [19]. According to Ref. [20], the metaverse is a technology that exists in cyberspace and materializes through the creation of 3D virtual digital worlds, in which different spaces for living and socializing are represented, giving rise to “parallel worlds”.

Reference [4] identifies four types of metaverse: augmented reality, lifelogging, mirror worlds, and virtual worlds. According to this author, augmented reality are the technologies that enhance information about the external physical world, layering this information and networking it so that people can explore it; this dimension is associated with the external/augmentation characteristic; life logging refers to the recording and reporting of the intimate states and life stories of objects and users. This dimension can be divided into two types: lifelogs of objects, which record the state of the environment and the condition of the physical world, and lifelogs, which record the history of users. The lifelog is associated with the intimate/augmentation characteristic; mirror worlds are enhanced virtual models of the physical world. The mirrored world is related to the external/simulation characteristic; and, finally, virtual worlds, understood as environments that simulate the economic and social life of communities in the physical world. This dimension is related to the intimate/simulation characteristic.

Metaverse technology offers a wide range of promising applications, spanning from gaming to its use in areas such as science, education, tourism, medicine, healthcare, and even the business world [21,22]. In this context, it is crucial to understand both the distinctive characteristics and the inherent challenges of the metaverse, as well as its ethical, economic, and social implications.

According to Ref. [5], “the most profound technologies are those that disappear” (p. 94). Therefore, we can see that technologies promoting complete immersion are becoming increasingly common and popular, dramatically altering human perceptual possibilities, which necessitates critical digital educommunication.

As immersive technology continues to play an increasingly significant role in all aspects of life, it is essential to understand the features that can foster creativity in immersive and metaverse environments. This context justifies the relevance of an integrative review to explore how recent research on the metaverse is addressing creativity as a fundamental and pertinent factor.

## 2. Methods

Systematic integrative literature review is an appropriate method for understanding phenomena in social areas because it takes into account empirical or theoretical studies, both experimental and non-experimental [23,24,25]. This type of review can be conducted on new or emerging topics, aiming for a holistic and synthetic conceptualization of the literature up to that point [26].

Based on the identified problem, the research question was formulated as follows: What characteristics should a metaverse environment possess to facilitate the development of creativity in its users?

Integrative literature review serves as an effective method for identifying the strategies used to promote creativity within metaverse environments and their outcomes for users in their immersive experiences [23,25].

**Table 1**

Stages for conducting an integrative review according to [23,24,27,14].

Stages	Description
Defining the topic and research question	Definition of the problem and formulation of a research question that will give rise to the main search strategies in the databases.
Establishment of inclusion and exclusion criteria	Use of databases and application of search strategies, especially inclusion and exclusion criteria.
Identification of pre-selected and selected studies	Reading the abstracts, keywords and titles of the publications, organizing the pre-selected studies and identifying the selected studies.
Categorization of selected studies	Development and use of a matrix for analysis, definition of supporting questions, categorization and analysis of data and information, creation of an individual library, and a step towards critical analysis of the selected studies.
Analysis and interpretation of results	Discussion of results.
Presentation of the knowledge review/synthesis	Creation of a document describing in detail the review and its results and a proposal for future studies.

Note. Prepared by the authors based on [23,24,27,14,25].

### 2.1. Procedures of the integrative review

Based on [23,24,27,14], a set of steps was determined for carrying out this integrative review. These steps are organized in such a way as to allow the study to be replicated. It also seeks to avoid bias in the interpretation of the data, defining not only the criteria for searching for studies but also the elements for analysis. Table 1 shows the steps that will be applied in this research.

Thus, based on the research question, the terms “virtual reality”, “metaverse” and “creativity” were determined as search keywords for use in the databases. These terms were selected after a preliminary review of the databases and thesauri. The term “virtual reality” was considered a synonym for “metaverse”.

Therefore, the key search terms used in the research were: Metaverse OR Virtual Reality AND Creativity. These expressions were applied to English-language databases to broaden the results.

For this work, the following main databases were used: SciELO, IEEE Xplore, Web of Science, Science Direct, Eric, and Scopus. The choice of databases was based on their relevance to the research context, as well as the necessary reliability for its execution. The search was conducted manually, with the division of database queries and document reviews among the researchers.

The following inclusion criteria were adopted: reviews, original, complete, open access that met the research objective based on the title, abstract, and keywords, without any time restrictions, displayed in order of relevance, and related to the research’s goal. No language restriction was applied. Duplicate documents were excluded based on the initial keyword and abstract screening. Table 2 organizes the inclusion and exclusion criteria adopted for this integrative review.

The absence of language restrictions for article selection aims to avoid bias or tendencies in the evaluation process. Emphasis is placed on cultural inclusivity and diversity as a critical factor.

After this initial filter, a full reading of the reviews was performed, and documents that did not focus on the main objective of the review and did not meet the content criteria were excluded.

Once the articles for full reading have been defined, data and information extraction and organization will proceed based on the application of supporting questions, or secondary questions, originated from the main research question. These questions will help guide the reading of the documents and organize the findings. As the research question is centered on understanding the characteristics that a metaverse environment must have to facilitate the development of creativity in its users, the supporting questions were determined as follows: “What technological characteristics are found?”; “What conceptual characteristics are found?”; “What uses have been given to these spaces?”; “Possibilities for new research?”; “What criticisms have been found?”.

Following the application of the search criteria in the databases and considering the previously defined steps for evaluating the found studies, the following section presents the results obtained, the analyses conducted, and discussions about the results.

## 3. Results, analysis, and discussion

In this section, the results of the database searches will be presented, considering the returns from each database and contextual information about them. Following that, the results of the analyses conducted on the selected studies are presented. At this point, a framework of foundational concepts was found, helping to understand the importance of the relationship between creativity applied in the development of immersive or virtual environments.

Creativity is a part of human nature, rooted in its essence, and directly related to the interaction with the environment and the context in which one lives [6,1]. When transferring this life experience to a new reality - in this case, a virtual one – it is necessary to understand how human beings behave in order to continue creating, solving new or known problems, and generating innovation.

### 3.1. Contextual elements of the integrative review

Regarding the integrative review, the first necessary evaluation is to have a broad view of what was found in the databases regarding the topic. In each search conducted in the databases, discrepant results can be found, which may lead to different assessments of what is being sought. Therefore, it is important to specify what was searched for in the databases and what was found.

Table 3 presents the overall results regarding the number of reviews found in each database and, at this initial stage, the relationship with the quantity of documents found.

The reviews considered for analysis were those that were directly related to the main objective of the review and underwent a complete reading. The databases were searched in March and April 2023.

**Table 2**  
Inclusion and exclusion criteria used to carry out the research.

Criteria	Definition
Text types	Reviews, original and complete
Access	Open-access
Carry out the research in	Title, abstract, and keywords
Time constraints	No time restriction
Presentation of results	Order of relevance
Language	No language restrictions
Duplicate documents	Excluded

Note. Prepared by the authors, (2023).

**Table 3**  
Reviews identified in each database and the quantity of articles ultimately considered.

Database	# Found reviews	# Reviews considered for analysis
Science Direct	01	01
Web of Science	10	06
IEEE X	03	01
Scopus	12	04
Eric	02	0
SciELO	0	0
Total	28	12

Note. Prepared by the authors, (2023).

The overall view of the database responses helps understand where the most suitable publications on the proposed topic are located, based on the search terms used.

From the general identification of studies, it is necessary to provide a bit more detail about the search and selection process, considering the criteria used to arrive at the final set of documents. To do this, the answers or actions applied in each stage of the adapted methodology were organized, as shown in Fig. 1.

Although the topic of the metaverse is commonly identified as recent, there are important studies conducted more than 15 years ago. The impact of technological advancements in recent years is undeniable and is reflected in the increase in publications. However, discussions about the concept of immersiveness can be traced back to earlier times. Fig. 2 depicts the distribution of studies over the years, based on the previously mentioned search criteria.

Upon understanding how the selected studies are distributed over time, an analysis can be conducted on the types of studies carried out, revealing that there are 2 documents using quantitative methods, 2 employing mixed methods, and 8 using qualitative methods.

### 3.2. Identified conceptual categories

The analysis of the texts revealed fundamental concepts about creativity and the metaverse. Regarding creativity, most of the texts did not address explicit concepts. Instead, they focused on exploring how the use of metaverses and immersive environments can

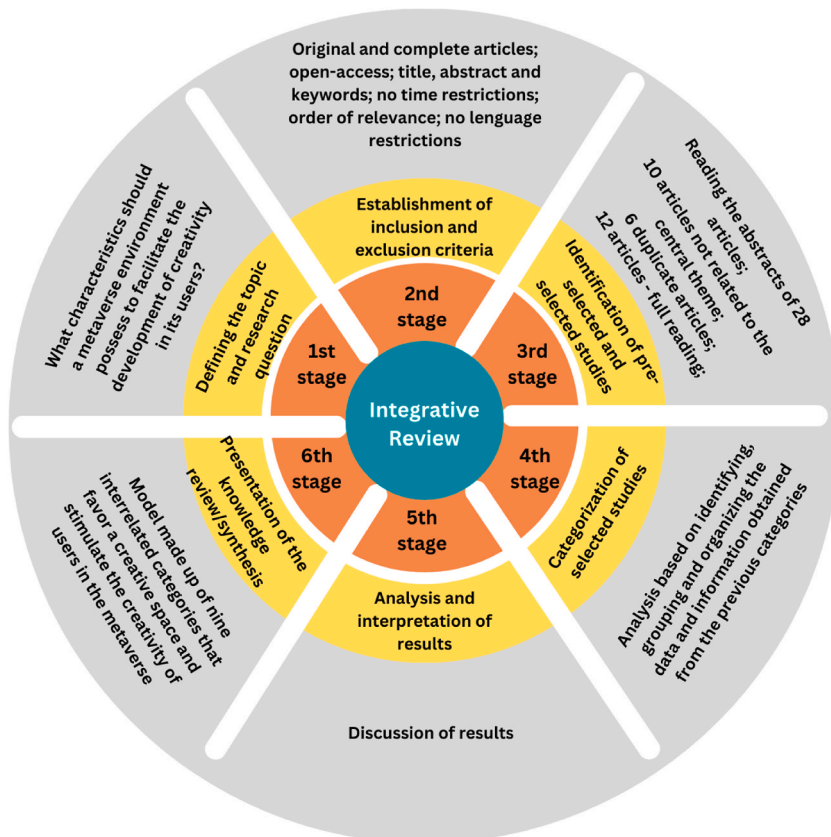


Fig. 1. Stages in the application of the integrative review methodology based on [23,24,27,14].

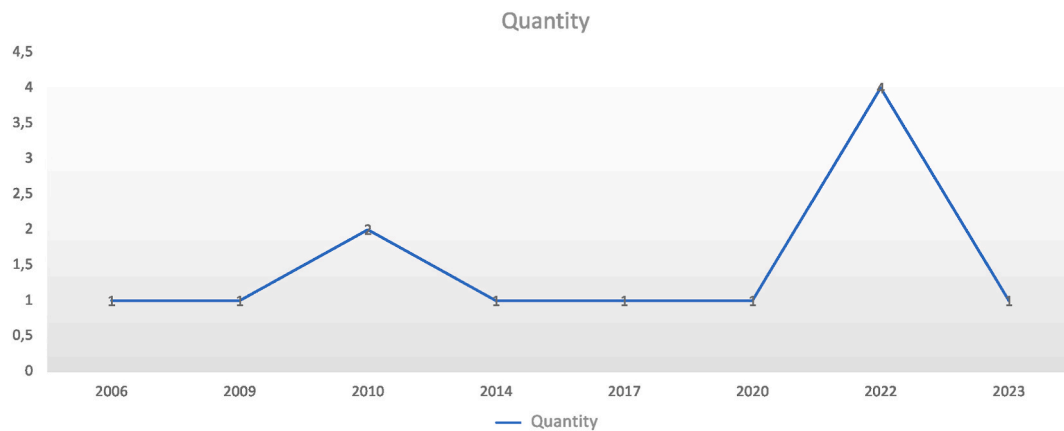


Fig. 2. Distribution of studies by year.

promote creativity in individuals.

[28] offered an interesting perspective on creativity, defining it as the result of the interaction of three elements: culture with symbolic rules, individuals promoting innovation, and experts who recognize and validate this information.

In the context of the metaverse, several related concepts emerged, especially in the field of art. The first is that of “meta-art” [29], describing it as an artistic expression unique to the metaverse, characterized by being open, interactive, performative, temporal, and interconnected. Another concept is “cyberperception” [30], which refers to perceptual competencies developed while immersed in a virtual environment.

The concept of “avatar” was also addressed in some studies. For some authors, avatars should resemble real-world people to create identification and comfort, promoting creativity. Others argue that the freedom to go beyond traditional human representation can stimulate creativity. Additionally, Ref. [27] emphasized the importance of making the avatar’s representation “diegetic” to integrate it into the environment.

Two concepts that underpin the importance of avatars are “telepresence” [30], referring to the feeling of being in one place while physically in another, and “embodiment” [31], which involves the juxtaposition of the real and virtual body.

As for the metaverse itself, it is described as three-dimensional digital spaces with varying levels of immersion, allowing interactions between avatars [32,30,33].

### 3.3. Identified technological characteristics

Technological characteristics play a fundamental role in creating immersive and virtual environments that promote creativity. These elements include Augmented Reality, Virtual Reality, Mixed Reality, Artificial Intelligence, and other technologies that extend the experience from the physical body to the avatar.

Between 2006 and 2017, the predominant platform for studies was Second Life, used in research related to art, culture, fashion, and education. Additionally, Minecraft Education Edition was explored for educational purposes, leveraging its combination of common virtuality and virtual reality.

In the field of education, two interesting developments were highlighted. MiLEX is a platform that considers pedagogical aspects, interaction with teachers, and promotes collaboration and the development of collective intelligence among users. Another approach utilizes WebStudio Gometa and Google Cardboard for content customization and student motivation.

Lastly, Ref. [30] presented a case in which an immersive environment was created to replace in-person knowledge-sharing events due to the COVID-19 pandemic. This environment was developed using Unity and WebGL, functioning on traditional computers.

## 4. Categories of sociodigital experiences in the metaverse

From the review, 9 categories have been identified to organize sociodigital experiences that enable creativity in the metaverse. These experiences pertain to social, collaborative, and cultural interactions that take place in three-dimensional virtual environments, such as the metaverse. The following sections provide details on these categories, linking each of them to the studies used.

### 4.1. Openness

According to the studies, openness is characterized by the creation of a democratic space where users of the environment can engage freely. In general, the internet is already considered a new paradigm of openness [29].

In this new horizon, openness is represented by the opportunity to change the purposes or uses of objects or contents within the environment [27]. It is about creating original content and interacting with the original creators, enabling qualified learning [34]. It’s



also about the possibility of collaborating to create something new [29].

This openness is a two-way street, as it allows users not only to consume content but also to create and transform it. Content here encompasses all elements available in the metaverse and on the internet, such as text, images, videos, audios, and even experiences. The experience represents the possibility of cooperative relationships with other individuals or entities (such as Artificial Intelligence).

Within openness as a characteristic for creativity, it is noteworthy that the virtual environment enables the overcoming of geographical limitations. People can come together, work collaboratively, or even meet individuals from other countries and cultures [29].

On the other hand, the space and openness in users' virtual existence are emphasized. In this sense, it is highlighted how the virtual life allows people to experiment and express their identity in creative ways, whether by creating a customized avatar or participating in creative communities within the virtual world [33]. The construction of the avatar is an important aspect of the openness characteristic, as also emphasized in the studies of [34,29,35].

Openness is, in some way, the expansion of reality for the expression of existence, and therefore, creativity.

#### 4.2. Persistence

Persistence is related to a dimension inherent to what constitutes a metaverse or an immersive environment. It is the ability to keep a record of users' actions in this environment. In the studies by Refs. [34,28,29], this same characteristic appears as a promoter or enhancer of creativity by users.

For [28], it is possible to relate this persistence to the fact of continuing to engage in the environment in such a way as to create a process of flow and pleasure, which paves the way for the long-term development of creativity. This enjoyment occurs precisely through remaining in the virtual environment and perceiving the continuity of situations, leading to dialogues, relationship spaces, and purpose-oriented communication derived from the main activity proposed.

On the other hand, the relationship with the concept of Life Logging establishes a connection for creation from the real-world perspective [34,36].

Persistence as a characteristic for the development of user creativity is related to the possibility of feeling a sense of belonging to the space and situation being experienced [34,28]. According to the study conducted by Ref. [28], it was found that this sense of belonging was as important as the mutual respect and admiration created among the members of the Virtual Orchestra. The results presented by Ref. [34] also indicate that the accessibility of the event for knowledge sharing before its formal start contributes to user appropriation, as well as to the establishment of dialogue and relationships.

#### 4.3. Collaboration

Collaboration is presented as a fundamental element for a space to be creative and help develop people's creativity [6]. In the studies used as references, collaboration also appears as an important characteristic for creativity and is, in most cases, related to the characteristic of openness [3,37,28,27,31,29].

Creative action increases considerably with the participation and involvement of people. Immersive environments that allow this interaction and collaboration among people and between them and the environment itself are more likely to promote creativity [37,27]. The metaverse provides an expansion of collaboration possibilities by considering interaction among people and with the objects within this environment. For [29], this expansion occurs because collaboration is not just through texts or words but through worlds and experiences.

People's participation is facilitated by the high possibility of interaction and construction, which is related to the real world but extends its reach.

Another important aspect of collaboration, still considered within the possibility of its expansion, is the extension and access to different cultures, the realities of people living in other countries. These are different ways of seeing the world, different approaches to problems or situations, social aspects, and more that can be shared and worked on collaboratively [28,31,29]. In this way, real problems in one community can be discussed based on the experiences of other communities around the world, not just through research results or promotional texts, but by experiencing the real, albeit simulated, environment and the possibility of constructing solutions.

The collaborative construction of content is also highlighted as a process for creativity, as seen in research related to education, in the teaching and learning process itself [37,27,36] or in the creation of content by teachers [32]. Unlike other platforms where the sole purpose is to play, the metaverse allows for collaborative content creation.

The virtual world is open to possibilities and can be created by users. Thus, not only graphic, and interactive content is designed, but also economic and social structures that impact both the real world and the virtual world [29]. In the same vein, integration with other users and the virtual environment influences creative choices and how this integration uses technology to create immersive and provocative experiences [3].

Collaboration fosters an environment where positive emotions, such as curiosity, happiness, resilience to change, and more, are related to the creative process [10].

Regarding art, especially music, Ref. [10] argues that among all the forms in which music was created, probably those of a collective nature have had the greatest transcendence. In the field of digital arts, the same is observed. Reference [29] found that works created in the metaverse helped change objects, incorporate active participation of viewers in the creative process, and, at the same time, introduced the idea of responsive and dynamic art, free of ideas or limited to a specific number of people.

#### 4.4. Sharing

Sharing is considered a characteristic for the development of creativity because, through the exchange of ideas and perspectives, people can make associations between the shared knowledge, thus generating new ideas. The space and openness to collaboration and the communications generated within a certain group are essential for people to contribute their own knowledge and, once shared, build new things: content, texts, videos, art, music, and new knowledge. In the selected studies, it is identified that shared creativity within the collaborative space is concretely realized through the construction of avatars [28,20,31], in the possibilities of the arts [3, 34,29], and in educational processes [37,27].

Understood as a foundation for creativity, sharing can be enhanced by various aspects found in the metaverse, such as less restricted community relationships, narrative and storytelling possibilities, collective construction, destruction, and craftsmanship [27,31]. When the immersive experience is structured in this way, it becomes a journey based on experience and engagement, identification, support, and feedback – elements that strengthen knowledge sharing [38].

Sharing goes beyond simple communication, as configured in some platforms like chat or email [29]. Therefore, the metaverse sets up a broader and more complex space where people can build their virtual identities and participate in social narratives, games, directed or non-directed interactive activities, surpassing mere communication [30,29].

#### 4.5. Metaphor

Metaphor is related to the ability of abstraction. Abstraction involves allowing one's thoughts to change a concept, situation, or object while retaining important and general ideas about it, while disregarding or transcending less important ones. Abstraction is an essential skill for creativity because it enables the association of different ideas to create something new or to solve problems.

It is linked to the ability to perceive the world metaphorically, beyond established forms, allowing for the non-literal and non-concrete. Therefore, it is related to fantasy and the expansion of one's imagination beyond the way we perceive reality.

The metaverse engages with these two abilities, abstraction and metaphorical thinking because even though it is based on the concept of mirrored worlds, which relates to reality, playful elements are present. To fully experience it and have the physical body merge with the virtual body, users must learn to navigate metaphorically [31].

In this sense, the embodiment of one's avatar becomes an experience and a process [31,29], making the user's actions more creative. Similarly, the metaphorical world created and still in the process of creation enhances users' creativity and is the result of this same creativity.

In the case of the orchestra presented in Ref. [28] study, the experience is quite comprehensive in the aforementioned aspects because the musicians create new instruments that are played unconventionally (such as flying). Furthermore, it is possible to have a synesthetic experience, mixing sounds, colors, lights, and textures created by the musicians in real time.

Metaverse environments, even though they offer highly diverse experiences, are generally built so that users have different perceptual and sensory experiences supported by technologies. Even in more formal experiences [30], the ability to abstract from reality is crucial for users to feel engaged.

On the other hand, leaving behind the physical body can stimulate other senses. The omission of the real body when using the metaverse frees up auditory and visual senses, leading users to a state of flow, facilitated by group creative processes, dialogue and collaboration, persistence, and creative freedom [28].

#### 4.6. Immersion and virtuality

The virtual environment, the metaverse, allows users to overcome geographical barriers and serves as a global space for interaction, suitable for creation, experimentation, and research [28].

In education, it has been identified that immersion through student action enables a significant experience as it transports them to another reality [27].

On a social level, immersion relates to cognitive and intellectual processes for interacting with other people, making decisions, and acting in virtual spaces to achieve specific goals. Social constructions are facilitated even among individuals who do not know each other in real life [30].

Another element identified regarding immersion is the semantic association that people make through the immersive experience. This occurs due to the symbolic factors identified in virtual spaces. These symbolic factors both enable abstraction and connect people to the real world [38,27].

Obviously, there is a reliance on technological devices to aid in this sensory immersion. There are various resources and peripherals that enhance the integration of senses in the virtual space [38]. The more human senses are engaged in the processes of learning, art development, or any type of activity carried out in the metaverse, the better the results obtained [38,32,30].

#### 4.7. Avatar – personification

Avatars have the function of being and doing. As beings, they ensure users' existence, permanence, and consequently, involvement in this real world, not merely restricting them to being passive observers. They can also be understood as a process and even as objects of interaction. Creating an avatar is an opportunity to strengthen one's existence in this virtual world [38,28,30,29].

In the study conducted by Ref. [31], the experience in the metaverse was the creation of avatars. Artists created avatars that served



as works for an exhibition in the virtual world. However, at some point, this experience was expanded, and other people could take these avatars, making interventions, changes, and appropriations freely.

In another study, Ref. [39] describes the creative process in a user's experience who creates multiple avatars, and each of them creates an independent fashion line. These creations assume and use various elements found in the virtual space, such as objects, landscapes, and animations. In this case, avatars had different appearances and genders, some even with non-human appearances.

Avatars can be associated with human appearance or not, and when they are, they do not necessarily resemble their creators. According to Ref. [38], in the study with students, using avatars like real-life people creates a greater sense of comfort and belonging, making users more comfortable performing their activities and participating in actions. This also allowed them to collaborate more easily in a virtual environment.

But this feeling is also found in other environments, not just in educational spaces. In an experience of organizing knowledge-sharing events, the fact that avatars maintain anthropomorphic proportions helped users create connections with other people [30].

The user's creation of the avatar strengthens participation and connection, regardless of how real it may be [29]. In some cases, it is considered advisable to maintain some level of formality and rigor, without losing the playful aspect, which is so characteristic of these virtual environments [30].

In another context, in a study conducted with an orchestra, musicians use avatars as musical instruments, creating their compositions through interaction with each other and the audience [28].

#### 4.8. Dynamic process

The dynamics and interaction among users characterize the metaverse as an opportunity for fostering creativity [37,30,27,29].

Technology, combined with art and other elements like intentionality in the educational process, has transformed students from mere spectators into participants, responsible users, and even content creators on the web [29]. The construction and reconstruction of content and knowledge directly involve users in the metaverse. It provides agency and offers the possibility of bridging the gap between the virtual and the real world.

In education, as mentioned, virtual worlds are attractive to both students and teachers as they blend ubiquitous learning with other forms of learning, such as mobile, digital, and hybrid approaches [27]. This favors dynamic models of student-teacher relationships, where the traditional model becomes dynamic, facilitating the creation of learning pathways and collaborative work.

This dynamism is also observed in other experiences beyond education, such as cultural management, event management, fashion,

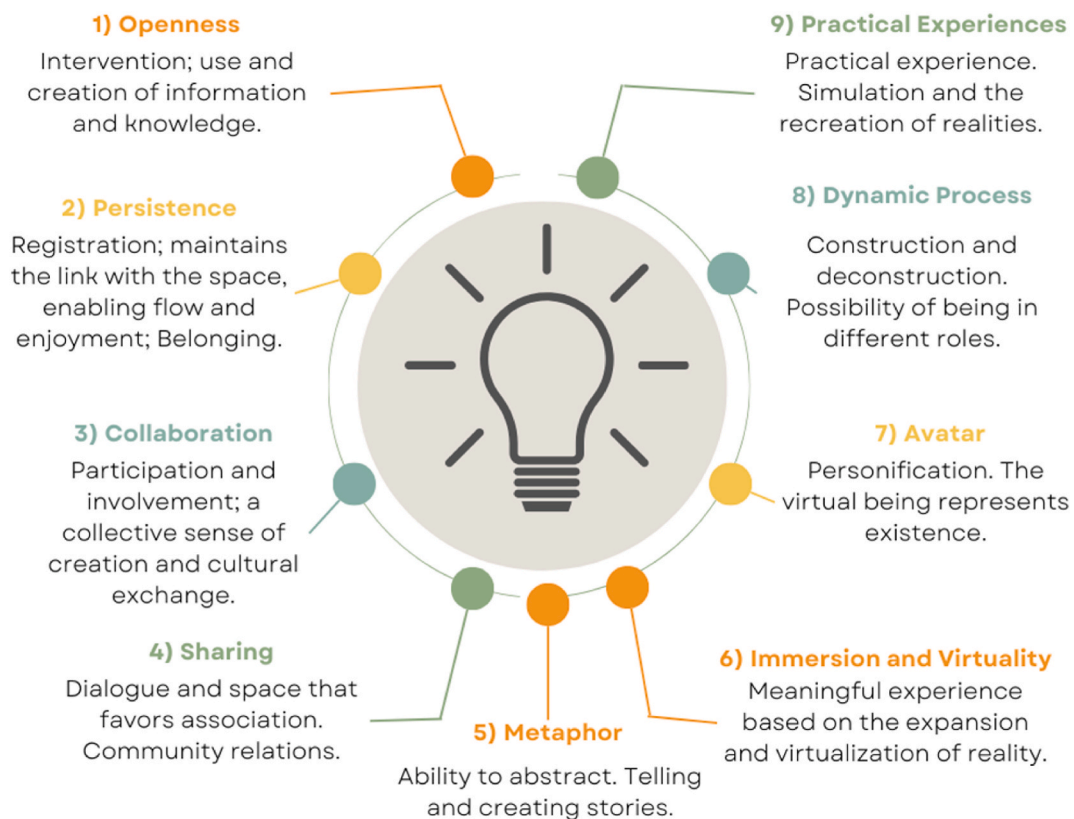


Fig. 3. Categories of analysis of sociodigital experiences and creativity.

and art creation [39,40,34,37,28,30,31,29]. The way the environment was designed for knowledge-sharing events [37,30] delineated spaces for entertainment and networking, for instance, allowing participants to interact within these spaces based on their interests and the event's purpose set by the organizers.

#### 4.9. Practical experiences

Simulation is one of the great opportunities of the metaverse. It allows for the recreation of situations in academic, professional, artistic, and various other contexts, expanding the possibilities of knowledge. Immersive technologies are replacing more challenging-to-create experiences with virtual ones, where individuals can be directly involved in the proposed situation, even if only in a virtual sense [38,28].

This simulation is made possible, once again, by the various technologies mentioned earlier, using mirrored worlds and digital twins to promote such experiences [40]. In the educational studies considered in this research, other elements regarding simulation stand out: promotion of meaningful learning, social interaction, development of analytical skills, communication skills, critical thinking, and creativity [38,40,27].

By increasing the possibilities of simulation and incorporating students' prior experiences and expressed interests, it is identified that students can take more effective responsibility for their own learning [37].

Another interesting factor is also identified from the experience of [27] using the Minecraft Education Edition platform, where students working in groups were encouraged to solve similar problems so they could share their experiences and help others solve problems similar to those they had already experienced. Students gain experience with this situation and grow in the game and in the learning process.

In the same vein of learning from similar past experiences, the study presented by Ref. [32] shows that content creation is an element that improves technological, creative, critical thinking, collaboration, and communication skills.

Finally, the risk reduction provided by simulators is an important factor in fostering creativity, as users may feel more comfortable experimenting and testing ideas without fear of making serious errors [39].

In conclusion, the reviews mention the use of technology as a characteristic for the development of creativity, as this technology not only enables the existence of virtual worlds but also makes possible some of the aforementioned characteristics, such as collective construction and the possibility of interaction, among others. It is also considered that this technology should be easy to use, and progress and development should make its use increasingly accessible [37].

Fig. 3 represents the organization of these categories that, in some way, form a set of recommendations that can be adopted for the creation or use of virtual environments or the metaverse.

The organization of characteristics or fundamental elements can vary depending on the target audience, considering the socio-demographic characteristics of people, access to technologies, digital literacy, and other potential barriers. Elements such as cognitive overload in metaverse environments, privacy concerns, and other aspects can represent significant limitations.

This study focused on understanding the characteristics present in virtual environments already used that contributed to the development of creativity in their users. In making this choice, the search was not for a specific type of virtual environment, but rather for the experience reported in previous studies that allowed for the identification of the previously presented characteristics.

Furthermore, it is hoped to overcome the polarized and exclusive perspective between the benefits and harms of using virtual environments in relation to the real world. The importance of discussions about these environments being conducted in an integral and holistic manner, involving not just the technology, but also the sociodigital elements that may facilitate the use of these spaces, is recognized. Therefore, the intentionality, methods, strategies, and purposes of use, as well as technological issues, are important in the discussion about the use of virtual environments. The existing barriers should be made explicit, transparent, and considered for the effective use of these technologies.

The next section presents, as final considerations, the main elements found in this research. In addition to the characteristics themselves, the importance of metaphor in the virtualization process is highlighted as an element that, even in the physical and real world, allows people to go beyond that reality.

## 5. Final thoughts

This study aimed to conduct an integrative literature review on the use of creativity in metaverse experiences with the goal of identifying the characteristics that stimulate users' creativity. The results of this analysis significantly contribute to understanding how immersive virtual environments can be powerful tools in enhancing creativity and innovation among users, as well as promoting a connection between human beings and the potential of this type of environment. The integrative review yielded 28 review studies from the databases, of which only 12 were related to the research topic. An increased interest in the subject is noted from 2021 onwards, coinciding with the launch of Meta's Metaverse.

The term "creativity" derives from creating something, giving existence to something. To create, one must first exist, have a presence. To enable creativity in the metaverse, the barrier of existence, of embodying individuals in this environment, must be overcome. In the studies conducted by Ref. [31], the virtual body does not oppose the real body; however, it reflects on the complexity of having a real body that cannot access the virtual world except through virtual existence - an avatar. They discuss corporeality as a metaphor, which is no different from other human experiences outside the metaverse. Still, the use of technology requires people to make constant metaphorical efforts, such as "opening windows" on the computer, "putting documents in the trash", "sending documents by email" (mail), among others. According to the author, metaphor is the element that can maintain a connection between the

real and the virtual.

Metaphor serves the function of making comparisons with implicit meanings that help understand a particular context. For this reason, it helps maintain a relationship between the real and the virtualized by transporting elements that situate them in the metaverse.

In reports related to education, to provide significance and socioemotional reality, the game or space mimics the real world but introduces original, non-real elements [40,32,27]. The identification of a campus, for example, or playful spaces for interaction, is considered important for the teaching and learning process and assists in the completion of individual and collaborative tasks assigned to students. Retrieving the characteristics and definitions of the metaverse from Ref. [4], what is identified here is related to the dimension of Lifelogging or persistence, which is the recording of the user's life experiences through the mimicking of natural elements such as rivers, mountains, blue skies, day-night cycles, weather changes, and more [27].

In addition to considering the physical space or virtualized natural environment, it is important to consider other aspects of human existence, such as learning cycles and opportunities for development and growth. Iterative experiences where users can engage in activities that allow them to evolve within a particular perspective, developing new knowledge and learning, such as an "experience journey" [38]. The real world is taken as a basis to propose virtual users with practical experiences, enhanced by virtual elements, enabling individual and collective development [38,37].

Advancing this discussion, it is necessary to consider the playful aspect that a virtual environment provides. Creativity uses resources such as lateral thinking [8] to expand the possibilities of creation. The metaverse inherently presents a set of characteristics that allow users to go beyond reality, such as the ability to fly or create objects that would not be feasible in the real world.

To enhance the creativity that is inherent in human beings, the virtual world employs elements and resources known in the real world and amplifies or resizes their existence in the virtual world through metaphor.

As a capacity to solve problems or create products [11], creativity can be explored in virtual environments. The representation of reality, simulating concrete situations, enhances results because it provides a safe space for trial and error without major financial implications.

From the perspective of [7], as creativity is a systemic process that considers not only the individual but also the context and the environment, the metaverse as a collective resource enables the development of creativity when intentionally inserted into various social interactions, such as formal and informal educational spaces, social and artistic events, knowledge sharing, organizational activities, and others.

Lastly, our analysis resulted in the identification of nine interrelated categories that favor a creative space and stimulate users' creativity in the metaverse. These categories include openness, persistence, collaboration, sharing, metaphor, immersion and virtuality, avatar and personalization, dynamic process, and practical experimentation with simulation. Although these categories may require revisions or regrouping in future research, their initial organization aims to guide creators and users of virtual environments in providing creative experiences that promote the development of this crucial skill in individuals.

The scarcity of specific studies on the relationship between creativity and the metaverse is evidenced by finding only 12 documents directly related to the theme of this investigation. However, despite the small number of studies found due to the method, which exclusively considers review studies, this fact does not diminish their relevance and potential contribution to the findings and results of the research. The quality and depth of analysis contained in these studies provide fundamental elements about the characteristics that a metaverse environment must have to stimulate the creativity of its users.

Furthermore, the fact that there are few studies stimulates the opening of the field for new research, allowing this work not only to be based on existing foundations but also to pave the way for new discoveries at the intersection between creativity and immersive technologies. The study presents a model articulating sociodigital analysis category for creativity with potential applications in new research or the development of virtual environments.

This research aims to demonstrate the potential of the metaverse as a possible space for creativity, emphasizing the importance of elements such as metaphor, playfulness, and collaboration that can transform the virtual experience into a fertile ground for innovation and sociodigital expression. Understanding these dynamics is essential to fully leverage the opportunities offered by immersive virtual environments.

### CRedit authorship contribution statement

**Ingrid Weingärtner Reis:** Writing – original draft, Investigation, Formal analysis, Conceptualization. **Artieres Estevão Romeiro:** Writing – review & editing, Conceptualization. **Carlos Henrique Berg:** Supervision, Methodology, Conceptualization. **Vania Ribas Ulbricht:** Validation, Supervision.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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