

ITU Focus Group Technical Report

(10/2023)

ITU Focus Group on metaverse
(FG-MV)

FGMV-03

**Guidelines to assess inclusion and
accessibility in metaverse standard
development**

*Working Group 8: Sustainability, Accessibility &
Inclusion*



Technical Report ITU FGMV-03

Guidelines to assess inclusion and accessibility in metaverse standard development

Summary

Promoting diversity, equity, and inclusion in metaverse via accessibility implementation requires careful consideration of diverse factors. This Technical Report discusses how to realize the principles on metaverse by articulating accessibility. Values are generated through a mixture of virtual reality, augmented reality, mixed reality, and extended reality. [b-Dreamson and Park]'s empirical study articulates six values: *bottom-up*, *collaboration*, *authorship*, *ownership*, *interconnectivity*, and *community*. This Technical Report investigates and improves upon limitations found in earlier research and practices and validates the United Nations' Sustainable Development Goal (SDG) principles, along with the six metaverse values for Digital Transformation (Dx) creating new values and cultures. Using these justifications, it explores guidelines for aligning metaverse platforms with the SDGs based on Dx, addressing the user experience dimensions of the platforms: *conception*, *interaction*, *interface*, *information*, and *usability* [b-Park a]. Universal design is the process of making a product accessible for everyone, regardless of their physical, sensory, or cognitive abilities. In this sense, metaverse should be inclusive of diverse cultures, languages, and perspectives, and should promote the SDG principles. By proposing guidelines and recommendations, the Technical Report strengthens the argument for articulating accessibility as a means of realizing inclusion in developing metaverse. The outcomes of the report are to articulate the values for metaverse SDGs in terms of digital transformation, to develop a set of guidelines for assessing inclusion and accessibility in metaverse, and to provide strategic and meaningful engagement with platforms towards SDGs.

Keywords

Accessibility, digital transformation (Dx), diversity, equity, inclusion, user experiences (UX)

Note

This Technical Report is an informative ITU-T publication. Mandatory provisions such as those found in ITU-T Recommendations are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

Change Log

This document contains Version 1.0 of the ITU Technical Report on “*Guidelines to assess inclusion and accessibility in metaverse standard development*” approved at the third meeting of the ITU Focus Group on metaverse (FG-MV), held on 3-5 October 2023 in Geneva, Switzerland.

Acknowledgements

This Technical Report was researched and written by Gayoung Park (The State University of New York, Korea (Rep. of)) and Neal Dreamson (The State University of New York, Korea (Rep. of)) as a contribution to the ITU Focus Group on metaverse (FG-MV). The development of this document was coordinated by Nevine Tewfik (MCIT, Egypt) and Pilar Orero (UAB, Spain), as FG-MV Working Group 8 Co-Chairs, and by Yong Jick Lee (Center for Accessible ICT, Korea (Republic of)) and Paola Cecchi-Dimeglio (Harvard University) as Co-Chairs of Task Group on accessibility & inclusion.

Additional information and materials relating to this report can be found at:

<https://www.itu.int/go/fgmv>. If you would like to provide any additional information, please contact Cristina Bueti at tsbfgmv@itu.int.

Editor:	Gayoung Park The State University of New York, Korea (Rep. of)	Email: gayoung.park@sunykorea.ac.kr
Editor:	Neal Dreamson The State University of New York, Korea (Rep. of)	Email: neal.dreamson@sunykorea.ac.kr
WG8 Co-Chairs:	Nevine Tewfik MCTI Egypt	Email: ntewfik@mcit.gov.eg
	Pilar Orero UAB Spain	Email: pilar.orero@uab.cat
Task Group Co-Chairs:	Paola Cecchi-Dimeglio Harvard University United States	Email: pcecchidimeglio@law.harvard.edu
	Yong Jick Lee Center for Accessible ICT Korea (Republic of)	Email: ylee@caict.re.kr

© ITU 2023

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

	Page
1	Scope..... 1
2	References..... 1
3	Definitions..... 1
	3.1 Terms defined elsewhere 1
	3.2 Terms defined in this Technical Report..... 1
4	Abbreviations and acronyms..... 1
5	Conventions 1
6	Background..... 1
7	Guidelines for aligning metaverse platforms with the SDGs based on Dx 5
8	Conclusion 8
	Bibliography..... 9

Technical Report ITU FGMV-03

Guidelines to assess inclusion and accessibility in metaverse standard development

1 Scope

The purpose of this Technical Report is to develop guidelines to evaluate metaverse platforms for the SDG principles of diversity, equity and inclusion in terms of Digital Transformation (Dx).

2 References

None

3 Definitions

3.1 Terms defined elsewhere

This Technical Report uses the following terms defined elsewhere:

None.

3.2 Terms defined in this Technical Report

This Technical Report defines the following terms:

None.

4 Abbreviations and acronyms

SDGs	Sustainable Development Goals
Dx	Digital Transformation
UX	User Experience

5 Conventions

None.

6 Background

Digital Transformation (Dx) involves using emerging technologies to create new business systems and models, while rearranging the process to change the business logic of a firm [b-Li et al], or its value creation process thus enhancing customer and employee experiences. Dx ultimately adds or creates entirely new values and reshapes the organizations [b-Verhoef *et al*]. The emergence of Dx escalates the emphasis on the optimal methodologies for value creation, the ideal structures for these new systems, and how participants can participate to create such values within them. In this context, this study posits that a metaverse environment provides distinctive values through its integrated and emerging realities which are hardly achieved through virtual or online environments. The objective extends beyond merely broadening the user base; it entails creating a metaverse experience that should be as fair and inclusive as possible. The study delves into the five dimensions of metaverse platforms in terms of User Experience (UX) design: conception, interaction, interface, information and usability. The study underscores the importance of a holistic approach to accessibility and inclusion in the metaverse. Accessibility and inclusion in metaverse should reflect the paradigm shift from “users consume information” to “participants create realities” in metaverse spaces. This shift necessitates ensuring that all users, with their diverse needs and rights, are not only represented

inclusively but can also be engaged accessibly in shaping experiences and realities in the metaverse. It can open a new avenue for research and practices into the social, economic, and cultural impacts on more inclusive and accessible metaverse.

Metaverse can be characterized as a fabricated construct that provides an immersive, three-dimensional and virtual setting that facilitates multi-user interaction online [b-Díaz et al; b- Hermann & Browning]. The environment allows individuals to engage with one another socially and economically, irrespective of their geographical location, by employing computational tools such as personified agents and simulation [b-Pena]. The study posits that a metaverse environment provides distinctive values through its integrated and emerging realities, which are hard to achieve through virtual or online environments [b-Dreamson & Park], as it fosters the creation of a new environment within an entirely new realm of reality. While prior studies have been focused on its technological features, including augmented reality, lifelogging, mirrored worlds, and virtual reality, in an empirical study, we found six distinctive educational values for metaverse-based learning, which were extracted from the four realities including virtual reality, augmented reality, mixed reality and extended reality, as shown in Table 1. The values include bottom-up, collaboration, authorship, ownerships, interconnectivity and (sense of) community that are closely related to the principles to achieve the SDGs.

Table 1 – Six educational values for metaverse

Value	Descriptions
Bottom-up	It is a self-governing space where we design and produce content by ourselves and set rules for the creation and use of space and content rather than perform a given task.
Collaboration	In the space, the qualities of space and content will depend on the quality of our collaboration. Collaboration is inevitable because we are always on the network, and no one is supposed to be isolated. Collaboration includes people-objects in terms of IoT, as well as people-people.
Authorship	When we produce and consume content by ourselves, we are all artists or writers. Instead of consuming the textbook content, we design our own learning content, activity methods and evaluation criteria. The structure of the space can be reconstructed according to the stream of our consciousness.
Ownership	Since it is a self-governing space, we are co-owners of the space. Physically, we would feel the ownership of the classroom space if we design it. Metaphysically, we also become the owners of learning if we design learning activities.
Interconnectivity	The space is part of a digital network. It is “already” connected not only to individuals but also to other communities. As anyone can participate in the space, so everything (people and objects) connected to the space becomes co-owners and co-authors.
Community	In a space where we all participate in production and consumption, we (participants and objects) form a community because “being together” is distinguished by a certain set of values or a worldview. Based on the worldview, the community has a shared decision-making process.

Source: [b-Dreamson & Park]

In the empirical study published in a peer-reviewed academic journal in 2023, primary and secondary school children (n=400) designed the forms of learning activities that they wished to carry out and metaverse spaces as their own learning environment [b-Dreamson & Park]. After reviewing the four realms of the metaverse – virtual reality, augmented reality, mixed reality and extended reality – we identified six educational values in epistemological and ontological contexts. These values were: bottom-up design, collaboration, authorship, ownership, interconnectivity, and community. By

emphasizing these values, we aimed to move away from a technologically deterministic approach to authentic learning. Using these values as guidelines, 80 groups with five students in each group redesigned 20 specified school spaces such as classrooms, teacher offices, science rooms and music rooms within their selected metaverse platforms (e.g., Gather, Town, Roblox, Minecraft, CSpace, Zepeto).

Thematic analysis indicated the six values were evidenced through several themes including collaboration with co-ownership and co-authorship, interconnectedness with all living and non-living beings, equal participation with diverse roles and responsibilities, and transdisciplinary involvement with scientific inquires.

These discoveries articulate such authentic metaverse engagement that is strongly aligned with the foundational principles of the United Nations Sustainable Development Goals (SDGs) encapsulated in the 5Ps: People, Planet, Prosperity, Peace, and Partnerships [b-United Nations]. As shown in Figure 1 below, the six values are not the sub-values of the 5Ps, but are considered the energy particles in the metaverse and boost the 5Ps in ways that the participants create and experience a reality where the 5Ps are realized. In this sense, the six values make contributions to each P as justified in Table 2. The essence of metaverse-based experience is to create a reality by participants for all.

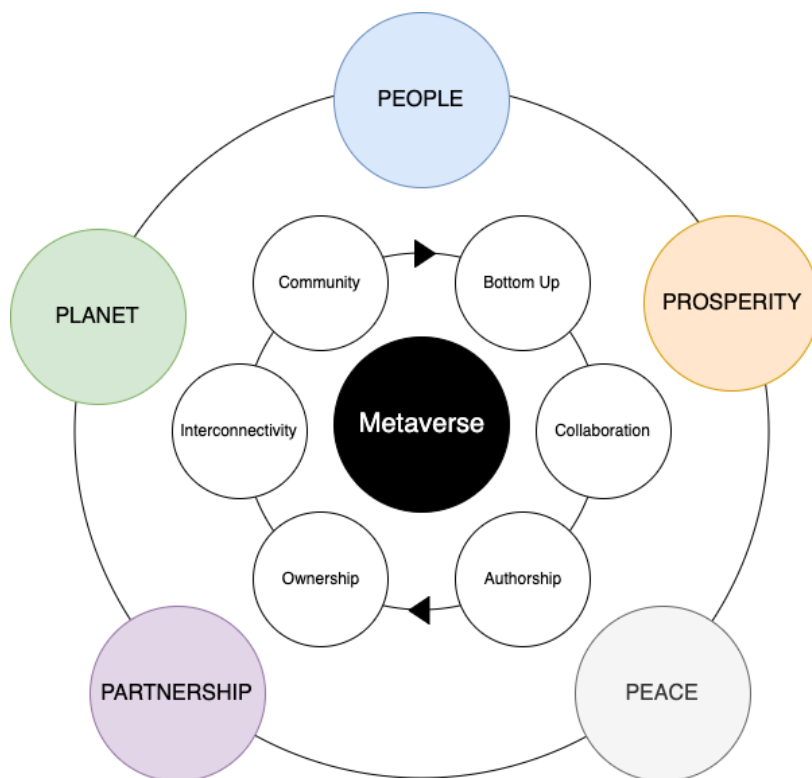


Figure 1 – The 5Ps by the six metaverse values

Drawing on the interplay between the six metaverse values and their potential advance the 5Ps of the SDGs, we have delineated the contributions of these metaverse values in relation to the 5Ps. These relations are outlined in Table 2.

Table 2 – Justified Contributions of the Six Values of Metaverse to the 5Ps

The 5Ps	Contributions of the Six Values
People	<ul style="list-style-type: none"> Participants are creators of reality by creating their own content, defining their own rules, shaping their experience, and constructing their own environment.

The 5Ps	Contributions of the Six Values
	<ul style="list-style-type: none"> • Participants are ongoing collaborators who create meaningful knowledge, objects and experience. • Participants are co-authors, which ensures that no voices are marginalized, and that equity, diversity and inclusion are promoted. • Participants are co-owners of reality who practice collective empowerment to ensure dignity and equality. • Participants realize full membership of the community through collaboration, co-authorship, and co-ownership.
Planet	<ul style="list-style-type: none"> • Participants are aware of, and discover, the interconnectivity of all living and non-living beings, which leads them to care for all of life and the planet. • Participants value the interconnectivity of the whole universe and humans' duty and responsibility to respect, protect and promote biodiversity and conversation. • Participants practice effective communication and collaboration with all living and non-living beings to create a healthy environment. • Participants envision the reconciliation between humans with non-human beings and nature by creating an interconnected environment. • Participants realize the needs of the present and future generations by reflecting togetherness right now in a sustainable environment.
Prosperity	<ul style="list-style-type: none"> • Participants are engaged with a healthy community for all by realizing shared values towards collective prosperity. • Participants are able to support local and global governmental bodies to be active for equal and shared prosperity, as they realize relevant values in the community. • Participants develop and practice authentic digital literacy and technological skills, which make contributions to digital economics. • Participants realize accessibility and inclusion in an equitable way by leveraging their potential to drive collective progress towards the whole universe. • Participants are able to create an inclusive version of prosperity based on co-ownership and co-authorship with non-living beings.
Peace	<ul style="list-style-type: none"> • Participants create a diverse range of inclusive values for all through transparent, equal and fair decision-making processes. • Participants discover real barriers to ending poverty and inequality by collaborating with all people, including socially vulnerable groups. • Participants build the capacity to communicate with both humans and non-humans through digitally mediated interactions • Participants make contributions to peaceful coexistence and communities through being engaged with ongoing development of shared values and responsibility. • Participants experience authentic global interactions through digital interconnectivity and involves in local and global issues, which foster an authentic glocal (global and local) mindset
Partnerships	<ul style="list-style-type: none"> • Participants' co-creation of an ideal environment together fosters co-authorship and co-ownership, which enhances the capacity to build strong and effective partnerships with anyone and anything. • Participants' research driven engagement because of their own problem defining and solution creation develops quality partnerships. • Participants' co-authorship and co-ownership provide opportunities for both individuals and groups to grow up. • Participants' engagement with co-construction of knowledge develops creative and innovative ideas and solutions for all.

The 5Ps	Contributions of the Six Values
	<ul style="list-style-type: none"> • Participants' interactions with non-humans and non-living beings generates universal values, which allows them to realize a solid universal partnership.

7 Guidelines for aligning metaverse platforms with the SDGs based on Dx

This section delves into how the unique values of the metaverse introduce supplementary considerations into the five elements of user interface design. While the outlined values form a solid foundation, their realization or successful implementation is not inherently assured within the metaverse. The actualization of these principles depends largely on the design and operational dynamics of the metaverse itself. To promote the internalization of these values, it is essential that the metaverse is designed strategically to endorse and stimulate such principles. Using the justifications recontextualized in the previous section, we suggest guidelines for aligning metaverse platforms with the SDGs by addressing the UX design dimensions of the platforms: conception, interaction, interface, information and usability.

The user-centred approach puts the emphasis on enhancing UX, highlighting its significance in design principles [b-Roto et al]. [b-Park a] identifies five core components integral to UX: concept design, interaction design, interface design, and information design, which lead to the consideration of accessible and inclusive usability. These components, while distinct in their functions, are not to be viewed as sequential phases but as interrelated and interdependent aspects of the whole design process. When a targeted UX is conceptualized, it is visualized in interface design, structured in information design, and functionalized in interaction design [b-Park b]. In other words, if the functions of interaction design are not well aligned with the visual representations, then the readability and legibility of structured information decrease, which indicates that the conceptualization of UX remains faulty. Likewise, if concept design does not properly reflect authentic values that users can achieve in a platform, the remaining components, regardless of whether they were developed in high quality and with high-tech, will malfunction. Therefore, it is important to note that these components all work together to promote accessible and inclusive usability, underscoring the core philosophy of user-centred design. Table 3 presents the re-defined five dimensions of UX design for inclusive and accessible metaverse design: conception, interaction, interface, information, and usability.

Pre-existing evaluations and protocols have been focused on consumption or development, which does make sense in that products are used by customers and produced by developers. Yet, they are integrated in a metaverse environment, and thus the focus of the approach should be switched to “design” in terms of “creating a reality”. In this sense, the five dimensions of UX design can be reshaped in a way to guide people, including users and developers, on how to create values. This approach allows them to assess their actions and ensure they align with the SDGs and the six core values.

Table 3 – Redefined dimensions of UX for accessible and inclusive metaverse design

Dimensions	Redefinitions	Descriptions
Conception	Problem solving for value creation	The metaverse platform or reality creation on it demonstrates problems the participants will solve or values they will create, how its decision-making process will solve them or its creation process will realize them, and what it will feel like as it is solving them or creating them.
Information	Accessible and inclusive communication	The metaverse platform or reality creation on it makes information interesting and easy to understand that fosters an efficient and effective engagement to realize or create values through diverse types of communication including verbal, non-verbal, visual and written.
Interaction	Communication and collaboration channelling	The metaverse platform or reality creation on it offers diverse communicative and collaborative channels that facilitate not only one-to-many but also other types such as many-to-many and many-to-one that are inclusive of minorities and non-human beings in ways to make collective contributions to the community or realize the values.
Interface	Visual and invisible engagement	The metaverse platform or reality creation on it organizes visual and invisible elements for all participants to play an active and representative part in evaluations , which affect the value creation and their voices shape outcomes.
Usability	Dialogic and relational culture	The metaverse platform or reality creation on it enables all participants to participate in its ongoing and participatory development that cultivates a culture of encounter and a dialogic relationship for all.

For the alignment with the 5Ps of the SDGs, we suggest shifting the focus to authentic user experience (UX) beyond functionality. That is, the focus should be on methodological engagement by all users through the redefined dimensions and descriptions. In this light, features and content are not just tools; they evolve into carefully designed realities. Therefore, emphasis should be placed on the production (creation) and decision-making processes, fostering diverse communication and collaboration channels, and ensuring continuous and meaningful participation by all stakeholders. This methodological engagement empowers the users to introspect and justify their activities on metaverse in terms of realizing the six values towards the SDGs.

Table 4 provides guidelines and recommendations for developers (or evaluators) to assess metaverse platforms when reflecting the redefined dimensions of UX for accessible and inclusive metaverse design.

Table 4 – Guidelines and recommendations for inclusive and accessible metaverse development

UX Dimensions	Guidelines and recommendations
Problem solving for value creation (Conception)	<ol style="list-style-type: none"> a. Ensure that all users can design personal avatars and may create entire virtual worlds so that they can generate a diverse range of experiences and environments that can enrich the metaverse. b. Ensure that all users can create and modify content in a collaborative manner.

UX Dimensions	Guidelines and recommendations
	<ul style="list-style-type: none"> c. Ensure that all users have shared spaces where they can collectively build knowledge, allowing them to contribute to and learn from a common pool of knowledge or experience. d. Ensure that all users can implement systems to recognize and value individual and collective contributions. e. Ensure that all users can implement a decentralized governance model where they can set their own rules and policies of the metaverse. f. Ensure there are clear pathways for users to report violations or conflicts they feel unable to resolve on their own.
<p>Accessible and inclusive communication (Information)</p>	<ul style="list-style-type: none"> a. Provide a guide or strategies on how to use all communication tools including voice chat, text chat, gesture recognition, and even emotion or facial expression mapping. b. Provide a guide or strategies on how to co-create content, including building virtual structures, developing narratives, or designing shared activities. c. Provide a guide or strategies that help users implement emotionally expressive avatars, which can convey feelings or moods, especially for those with specific needs in verbal communication. d. Provide a guide or strategies on seamless transitions between different communication modes, allowing users to switch based on their context and preference. e. Provide multi-model sensory options for any content and communication, allowing for accessibility when one sensory mode is not feasible. f. Provide an integrated AI-driven, or human moderator to support quality and ethical communication.
<p>Communication and collaboration channelling (Interaction)</p>	<ul style="list-style-type: none"> a. Facilitate users to have freedom and versatility to generate original content tailored to their unique preferences and styles. b. Facilitate users to participate in immediate, real-time interactions and in asynchronous collaborations, allowing participants to work together seamlessly, regardless of time zones or differing schedules. c. Facilitate users to participate in adaptable group formations, enabling participants to dynamically form, modify, or dissolve teams/groups, thus fostering more meaningful and effective collaborations. d. Facilitate users to participate in peer review mechanisms and live demonstration areas; real-time feedback ensures participants can promptly refine and enhance their creations, promoting a culture of mutual growth. e. Facilitate users to participate in the backbone of a user-driven ecosystem where everyone contributes to its continual evolution. f. Facilitate user to participate in richer levels of agency into internal and external activities on the whole network.
<p>Visual and invisible engagement (Interface)</p>	<ul style="list-style-type: none"> a. Indicate how the needs and preferences of individual participants, including ones in specific needs are addressed and responded. b. Indicate how to create their own content and share it with all users. c. Indicate how to navigate values in the spaces. d. Indicate how to control interactivity and empower other users.

UX Dimensions	Guidelines and recommendations
	<ul style="list-style-type: none"> e. Indicate what procedures and policies should be followed to have high quality learning experiences. f. Indicate what elements facilitate critical thinking, creativity, communication, and collaboration are available.
<p>Dialogic and relational culture (Usability)</p>	<ul style="list-style-type: none"> a. Offer diverse and alternative forms of communication (non-verbal communication, speech-to-text, text-to-speech options). b. Offer tutorials, guidance, and support mechanisms that enable users of all abilities to interact with the environment effectively and efficiently. c. Offer clear explanations of the purpose of each algorithm, if possible. d. Offer to learn how algorithms work and how to create them. e. Offer information sessions on how algorithms impact the user experience. f. Offer ways to discover a wide range of internally and externally connected content and beings beyond algorithms.

8 Conclusion

This Technical Report has defined the values for metaverse SDGs within the context of digital transformation. The six metaverse values inherent in the user-centred approach align remarkably well with the foundational principles of the SDGs, embodied in the five pillars: People, Planet, Prosperity, Peace and Partnerships. These principles advocate for equity, accessibility, and active participation in decision making and creation processes in metaverse which echo loudly in the realm of metaverse-based experiences.

In order for these values to be effectively internalized and thus to support and encourage the principles, this Technical Report provides redefined dimensions of UX for accessible and inclusive metaverse design.

The guidelines for evaluating inclusion and accessibility in metaverse platform or reality creation ensure strategic engagement and facilitate the development of authentic experiences that align with the SDGs.

Bibliography

- [b-Albert & Tullis] Albert, B., & Tullis, T., (2022). *Measuring the User Experience: Collecting, Analysing, and Presenting UX Metrics*. Morgan Kaufmann.
- [b-Bruno & Muzzuppa] Bruno, F., & Muzzupappa, M. (2010). *Product interface design: A participatory approach based on virtual reality*. *International Journal of Human-Computer Studies*, 68(50), 254-269. DOI: 10.1016/j.ijhcs.2009.12.004
- [b-Diaz *et al*] Diaz, J., Saldaña, C. & Avila, C. (2020) *Virtual world as a resource for hybrid education*. *International Journal of Emerging Technologies in Learning*, 15(15), 94-109.
- [b-Dreamson & Park] Dreamson, N., & Park, G. (2023). *Metaverse-Based Learning Through Children's School Space Design*, *International Journal of Art & Design Education*, 42(1), 125-138. DOI: 10.1111/jade.12449
- [b-Herman & Browning] Hermann, J., & Browning, K. (2021) *Are we in the metaverse yet?* (online). Retrieved [2 April 2023] from <https://www.nytimes.com/2021/07/10/stylemetaverse-virtual-worlds.html>
- [b- Guan *et al*] Guan, J., Irizawa, J., & Morris, A. (2022). *Extended Reality and Internet of Things for Hyper-Connected Metaverse Environments*. 2022 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp.163-168), Christchurch, New Zealand, 2022, DOI: 10.1109/VRW55335.2022.00043.
- [b- Li *et al*] Li, L., Su, F., Zhang, W., Mao, J.Y. (2018). *Digital transformation by SME entrepreneurs: A capability perspective*. *Information Systems Journal* 28 (6) ,1129-1157.
- [b-Park a] Park, J.Y. (2015). *Cross-cultural language learning and web design complexity*. *Interactive Learning Environments*, 23(1), 19-36. DOI:10.1080/10494820.2012.745427
- [b-Park b] Park, J.Y. (2012). *Design process excludes users: The co-creation activities between user and designer*. *Digital Creativity* 23(1), 79-92. DOI:10.1080/14626268.2012.658814
- [b- Peña] Peña, J. B. (2014) *Metaversos para el master siberamericano en educación en entornos virtuales, E-Learning inteligente y adaptativo, un paso más hacia la humanización y la inclusión educativa*, *Artículos, Páginas*, 2(14), 227–248.
- [b- Roto *et al*] Roto, V., Law, EL-C., Vermeeren, APOS., & Hoonhout, J. (2011). *User experience white paper: Bringing clarity to the concept of user experience*. s.n.
- [b- Verhoef *et al*] Verhoef, P.C., Broekhuizen, P., Bart, Y., Bhattacharya, A. Dong, J.Q., Fabien, N., & Haenlein, M. (2019). *Digital transformation: A multidisciplinary reflection and research agenda*. *Journal of Business Research*, 10.1016/j.jbusres.2019.09.022
- [b-United Nations] United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development. Sustainable Development Goal 4*. Retrieved [1 April 2023] from <https://sustainabledevelopment.un.org/sdg4>

[b-Zhao *et al*]

Zhao, Y., Jiang, J., Chen, Y., Liu, R., Yang, Y., Xue, X., & Chen, S. (2022). *Metaverse: Perspectives from graphics, interactions and visualization*. *Visual Informatics*, 6(1), 56-67. DOI: 10.1016/j.visinf.2022.03.002
