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ORIGINAL RESEARCH ARTICLE

Metaverse to foster learning in higher education

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ABSTRACT

This research refers to the new information and communication technologies that have emerged in recent years and that are being used in education as a pedagogical resource. Thus, Metaverse have been applied in universities obtaining great benefits such as improving interaction and communication between students and teachers through personalized avatars regardless of the physical limitations of the real world, developing skills and abilities that encourage learning and immersion, leaving aside the traditionalist learning. The use of Metaverse in education aims to make the student the protagonist of his or her own learning and, in addition, seeks to improve collaborative learning to encourage active participation among students through the interaction of avatars within the Metaverse. As a practical alternative and an emerging trend, the tool "AltspaceVR" is proposed for higher education. The sample of this study consisted of 159 graduates between the ages of 18 and 35 who were pursuing their doctoral, bachelor's, master's or other studies, and 7 experts working as teachers in Spanish universities, including a doctor in educational methodologies who has been named "Professor of the Year" on several occasions. Among the main conclusions of the study we have obtained that students consider that the implementation of Metaverse in higher education will promote learning and immersion, allowing the development of pedagogical activities in a more innovative and interactive way thanks to its graphical interface. On the other hand, from the results of the survey we conclude that the teacher lacks knowledge to make adequate use of Metaverse as a pedagogical resource, using only two-dimensional and mainly verbal platforms that only generate a traditionalist and non-interactive learning.

Keywords: Metaverse; avatars; meaningful learning; interaction; communication; AltspaceVR

1. Introduction

This research work raises the need to implement three-dimensional virtual worlds or Metaverse in education, understood as fictional constructions in which both students and teachers interact through avatars (virtual clones) created by themselves in a virtual environment that simulates the physical space where the participants interact, but without the physical limitations of the real world.

From an educational point of view, this type of technology is considered necessary to be used in classrooms to promote immersive learning[1], it is a type of learning that uses and plays with 360º videos—as it provides a series of advantages that other types of technologies have not achieve, we observed throughout history.

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Although distance education was actively developed from the year 2000 onwards in tele-training or e-learning environments (methodology that is developed through the Internet or connected to the network), it was not until the global pandemic of Covid 19 that the need for virtual spaces in the classroom was born. This was because this situation brought with it innumerable changes and disruptions in broad sectors of human activity. One of the most affected, due to the administrative imposition of the total closure of educational centers in most countries of the world, has been education.

Technology emerged as a great ally for overcoming some of the educational challenges in times of pandemic, with possibilities beyond online classes—on countless occasions a reality wasted due to a lack of digital literacy or a lack of knowledge of new educational methodologies. Gradually, platforms and tools were created in immersive environments that favored two-way communication and generated an interactive paradigm in which students could work with objects. The Metaverse was far from being exclusive to the video game industry and began to be used more and more in research, experimentation and education.

Metaverse aims to awaken the senses and take students to live an experience on another level, awakening their motivation, curiosity, involvement and creativity, thus favoring the assimilation and understanding of content in a natural way. A tool that will offer students the possibility of carrying out joint simulations with other students by sharing online resources[2].

By making use of Metaverse and all the benefits they generate within education, teachers and graduates will be involved in interacting in a playful, dynamic and creative way within the teaching-learning process.

In short, choosing the right Metaverse applications will enable graduates not only to achieve the educational objectives and competences set out in the curriculum, but will also help them to develop their creativity, logical thinking, spatial skills, time optimization and responsible use of electronic devices.

2. Literature review

The incursion of new information and communication technologies (ICT) into teaching is a fact, and this is mainly due to the fact that the use of these technological and digital media is being developed as part of training in education. However, the use of these media does not guarantee favorable results in the acquisition of knowledge. It is also essential to take into account other factors such as the teacher's knowledge and use of ICT in their daily work and the variety of existing methodologies to achieve the learning objectives, and it is necessary to reflect on those favorable methods in the classroom that make use of ICT[3].

Nowadays, every system is in constant evolution, especially one of the most important ones such as education, and therefore, the way of teaching must be adapted to the new social context. This means that the role of the teacher must change in order to adapt to the current and future needs of their students.

The new generation of students are digital natives who have an innate ability of language and the digital environment, as they have adopted ICT in the first instance. Technology is central to their lives and they make use of it for all kinds of daily tasks, so they cannot conceive of education without connection to the world. Given this situation, it is essential for teachers to implement active methodologies that are capable of awakening the interest and desire to learn of these young people.

Meaningful learning presents a series of advantages that rote learning does not offer, such as: facilitating the acquisition of new knowledge related to what has already been learned in an eloquent way, as it produces a modification of the student's cognitive structure to integrate the new

information; retaining the new information in a more lasting way by relating it to the previous one; better assimilating the concepts acquired from active learning through the activities that the student carries out on their own. Lastly, generating a unique and personal learning that depends on the student's previous knowledge. It is necessary to promote and disseminate the insertion of ICT at all levels of the education system to achieve meaningful learning, to propose a change in the traditional teaching-learning methods, to encourage personalized education, and to promote the creation of programmed that facilitate the presentation of content, as well as the search for information. So, ICT should be considered as an inexhaustible resource that should be maximized. Linking education and ICT is a necessity, as it helps students to acquire a reflective and enriching practice[4].

In today's learning environments, if teachers want their graduates to achieve meaningful, autonomous and innovative learning, they must prioritize the use of didactic resources, encourage collaborative work, make teaching more dynamic and dispense with traditional pedagogy.

Despite the fact that the use of ICT in education plays a fundamental role in implementing meaningful learning, the reality is that there are still insufficiencies to achieve this, as teachers are unaware of the ICT tools available to develop this type of learning in their students. There is little training for these teaching professionals on the methods or ways to tackle this task and insufficient resources from the administration to put them into practice in the centers.

From all of the above, it can be deduced that it is necessary to search for and implement new, innovative virtual spaces that create innovative and enriching experiences for students[5]. In this line, the technological and educational reality in the university classrooms of the current education system comes from the incorporation of new digital resources offered by the Internet to interact with graduates in a more interactive, playful and participatory way. Digital blackboards, tablets, computers and online classes now seem to be obsolete concepts because of the Metaverse, i.e., the virtual worlds that are about to arrive in educational centers to make learning a totally immersive experience[6].

The Metaverse is a virtual or alternative space in which real or fictitious situations are recreated and where people interact with other users through avatars so that they can enjoy new experiences. This virtual space encompasses a network of virtual universes that is interconnected and accessed through an electronic device connected to the Internet. Another widespread definition states that Metaverse are immersive 3D environments in real time, whose nature as a container space makes them ideal for hosting audiovisual content, giving rise to enormous possibilities in the area of training[7].

The metauniverse is derived from meta (beyond) and universe, hence its acronym "Metaverse", a concept that refers to the next generation of the Internet. The main characteristic of the metaverse is that it provides a highly immersive and multi-sensory experience. The term Metaverse originates from a novel written by Neal Stephenson in 1992, called "*Snow Crash*", which recreated a collective and frequently shared virtual world that was created by convergence and compatibility with aspects of external activity[8].

There are multiple tools that do not interoperate, making data transfer difficult. However, Blockchain technology enables secure data transfer, identifying the origin of the data being shared and its authorship, and also contributes to the standardization of communication protocols between the various Metaverse platforms[9].

The attention level of students increases considerably thanks to the graphical enrichment and multimedia offered by the Metaverse. In addition, these students express their level of satisfaction and empathy through their avatar which makes them

unique in these scenarios and helps them to socialize with others, which favors discovery learning, role-playing strategies, interaction and provides them with a meaningful learning experience. Another feature to highlight is that 3D virtual environments offer graduates the possibility of interacting with the teacher in a participatory and creative way in real time, which represents the essence of a face-to-face class. In addition, they allow content to be adapted and personalized according to the profile and level of personal knowledge[10].

With Metaverse, students learn by doing and by trying out different formulas or ways of solving practical problems, which helps to develop divergent thinking. This new learning method therefore has the potential to engage graduates while motivating them to explore the material from a number of different perspectives and has been shown to be very useful for teaching subjects that students would not be able to experience first-hand in the real world[11].

Although there are a multitude of Metaverse applications in which educational initiatives have already been presented such as Decentraland, Metaverse school or Second Life, among others, AltspaceVR is recommended for higher education because it provides a number of features that make it very interesting and attractive from an educational perspective[12]. It is a leading free platform from Microsoft for virtual experiences that makes it easier to create events.

It also exceeds the scope of videoconferencing, as it has a set of tools for the creation of worlds, and the facility to add productivity elements such as web browsers to view presentations and decorative elements that allow an effect of immersion and direct interaction[13].

3. Objectives of this research

The main objective of this study is to analyze the use of Metaverse as a new emerging methodology that favors learning and immersion in higher education and allows teachers to train graduates with the knowledge and skills necessary to achieve professional success.

Similarly, this research aims to achieve the following specific objectives:

a) To improve the processes of social and educational interaction between students and teachers through the use of avatars within the Metaverse.

b) To propose a Metaverse appropriate to the results obtained in the extracted samples, which provides them with information in a natural way and in accordance with their abilities and learning channels.

4. Methodology

The methodology or theoretical framework includes the set of techniques and procedures used to formulate the hypotheses, solve the question and carry out the research.

It is one of the most important sections of the research and is composed of elements that cover both the approach to the object of study and the research design: methodological approach, research area, type of study, data collection techniques, population and sample analysis and, finally, plan for tabulation and analysis of the data collected.

4.1 Methodological approach

This research work is both quantitative and qualitative in nature as it directly relates the problem to learning and educational immersion. On the one hand, it is quantitative because mathematical and statistical processes will be used to evaluate the data collected from the samples and, on the other hand, it is qualitative because it will evaluate the Metaverse and their influence on the teaching process in university education.

Likewise, it is important to highlight that the researcher becomes the actress of the study and an entity of social change where she interacts.

4.2 Research area

The present research is carried out in Spanish universities in the last week of May and the first week of June 2022 (this short time interval is established in order to complete the study on the established date) in both private and public centers, as well as in the different teaching modalities that exist in this country: face-to-face, blended and distance learning.

The fieldwork was carried out in these universities because that is where the problem arises and where the population under study is located, in order to systematically obtain and process the information collected, taking into account the proposed objectives.

In order to elaborate this work, primary scientific sources related to the fact being investigated have been consulted, allowing us to analyze, deepen and compare different points of view of the authors on the use of Metaverse in the field of teaching, therefore, it is a bibliographic document.

4.3 Population and analysis sample

The sample consisted of 159 graduates between the ages of 18 and 35 who were pursuing doctoral, bachelor's, master's or other studies, and 7 experts working as lecturers in Spanish universities, including a doctor in educational methodologies who has been named lecturer of the year on several occasions. As these are people with common interests and expectations, the information collected is reliable, which favors the study (**Table 1**).

Table 1. Sample: 7 university professors

Expert in	University	Kind of education	Total
Computing inginnering	UGR	On site	2
Childhood education	UGR	On site and on line	1
Marketing, sales and digital marketing	Miguel de Cervantes	On site and on line	1
Technology, innovation, AI and Cybercriminology	UC3M, Nebrija, UNIR, IE, Miguel de Cervantes	On site and on line	1
Sales management	Miguel de Cervantes, eCornell y Escuela de Negocios y Dirección	On site and on line	1
Law	UNED	On line	1
Total participants			7

Quantitative data were collected through a four-point Likert scale survey and instrument to measure the degree of user satisfaction and eliminate neutral responses, forcing the respondent to choose either a negative or a positive option. To validate the reliability of the four-point Likert scale, Cronbach's Alpha coefficient was used[14], obtaining a reliability percentage of excellent of 0.9, as shown in **Table 2**.

On the other hand, the Google Forms application was used to collect this data by sending the link via WhatsApp and sharing the HTML on some Social Networks such as Facebook, Instagram and LinkedIn. Quantitative data were analyzed using descriptive statistics and Pearson's Chi-square (X^2)[15], while qualitative data were analyzed using documentary content analysis, generating units of analysis and categories of study..

Table 2. Cronbach's Alpha value obtained for the four-point Likert scale

Formula to obtain the value of Alpha of Cronbach coefficient $\alpha = \frac{K}{K-1}\left[1 - \frac{\sum_{i=1}^{k} S_i^2}{S_T^2}\right]$				
Meaning of the uiuknows in the above formula	S_i^2	Variance of each item	Values obtained	S_i^2
	K	Number of items		K : 14
	$\sum_{i=1}^{k} S_i^2$	Sum of variances of the items		$\sum_{i=1}^{k} S_i^2$: 16.06
	S_T^2	Variance of the sum of the items		S_T^2: 98.92
	α	Cronbach's Alpha coefficient		α: 0.9
Range for measuring the value of:	α = 1	Perfect	Conclusion	The Cronbach's Alpha value (α) of this research is 0.9 which shows that according to the established ranges the instruments used is an excellent reliability
	α ≥ 0.9	Excelent		
	α ≥ 0.8	Good		
	α ≥ 0.7	Acceptable		
	α ≥ 0.6	Doubtful		
	α ≥ 0.5	Inacceptable		

5. Results

This section analyses and interprets the data and results obtained in the research, both in the interviews conducted with teachers and in the surveys sent to graduates.

5.1 Analysis and interpretation of teacher interviews

The aim is to reach a consensus among the questionnaires received[16]. In short, this method helps to gather objective opinions or opinions based on the experiences of a group of specialists in order to make better decisions on the subject under investigation, in this case Metaverse.

With the aim of improving the readers' understanding of the topic covered in this section, **Table 3** shows the subject and profile of the experts, **Figure 1** shows the panel of experts used in the study and **Table 4** shows the results obtained from the interviews conducted with the teachers.

On the one hand, it can be said that teachers are partially unaware of the implementation of Metaverse or three-dimensional virtual worlds in higher education and this is mainly due to the fact that universities lack the necessary equipment to be able to apply this method.

On the other hand, these experts stated that for learning to be meaningful, the most appropriate type of teaching is hybrid, i.e., a combination of traditional teaching and Metaverse, since virtual environments are currently essential, as well as direct and personal contact is necessary and irreplaceable.

Therefore, it is not only necessary to train teaching staff in the use and management of Metaverse in order to achieve immersive education within the educational institution, but it is also necessary for centers to commit to this type of methodology and to acquire the necessary infrastructure to implement it in the higher education system.

Table 3. Panel of experts and universities where education experts teach

Approach	**Expert's profile**
We want to know if Metaverse are a methodological tool that promotes learning and immersion in university classrooms	Academic doctors from different Spanish universities

Figure 1. Panel of experts and universities where teaching experts teach.

Table 4. Teacher interviews

Analysis	Category	Segment
Implementing Metaverse for classroom delivery	Metaverse in education today	Partial lack of knowledge of this methodology Lack of means to use the method in universities
Virtual environments create dependency and make students unreflective	Virtual enviroments	Virtual environments are indispensable to today's educational process, indeed, in distance education they are a model to be followed
Metaverse enhance immersion, knowledge retention and interest	Metaverse fosters competencies in graduates	Encourages immersion and interest of graduates Improves retention if the methodological approach is appropriate. Direct and personal contact is necessary and irreplaceable
Traditional teaching or Metaverse	Choice of teacher	Hybrid, combining both methodologies
Desire for training in Metaverse	Metaverse training	Teachers want to be trained in Metaverse because it is a methodology and because it will be increasingly present in all fields
University system bets or not on Metaverse	Introduction of Metaverse in Universities	No, because there are barriers

5.2 Analysis and interpretation of graduate interviews

The data and results obtained from the student surveys made it possible to carry out a general analysis that served to determine whether the Metaverse promote learning and immersion in higher education, as this is the object of study of this research work.

The analysis is carried out by means of an individualized study of each question in the questionnaire sent to the graduates. To this end, a table is drawn up which includes the number of the question together with its wording, the possible response alternatives, the frequencies obtained, the corresponding percentages and a brief conclusion (**Tables 5** to **28**).

Table 5. Level of studies

Level of studies			
–	Level	–	%
	Grade	–	25.4
	Master	–	61
	Doctorate	–	3.4
	Others	–	10.2
	Total	–	100

According to the results shown in this table, of the 159 students surveyed, 61% are currently pursuing a master's degree

Table 6. Approach of its studies

Approach of its studies			
–	Category	–	%
	Art and humanities	–	13.6
	Sciences and health sciences	–	20.3
	Social sciences and law	–	49.2
	Engineering and architecture	–	16.9
–	Total	–	100

49.2% of the sample study Social Sciences and Law, suggesting that students prefer these studies because they think they will have better job opportunities

Table 7. Year of studies

Year of studies			
	Year	–	%
	1º	–	61.0
	2º	–	18.6
–	3º	–	5.1
	4º	–	15.3
	Total	–	100

According to the data in this table, 61 % of the 159 graduates surveyed are currently in the first year of their studies. This percentage is so high due to the fact that the vast majority of them are doing a university master's degree which lasts only one academic year

Table 8. Age of students

Age			
–	Age	–	%
	From 18 to 21	–	3.3
	From 22 to 25	–	11.9
	From 26 to 30	–	35.6
	From 31 to 35	–	49.2
	Total	–	100

49.2% of the sample is between 31 and 35 years old, which reflects (as in previous questions) that the majority have completed their undergraduate studies and are currently studying for a master's degree

Table 9. Gender

Gender			
–	Gender	–	%
	Female	–	66.8
	Male	–	33.2
	Total	–	100

Once the data has been collected in this table, it can be seen that 66.8% of the respondents are women, which indicates that this gender is more likely to participate in this type of survey

Table 10. Knowledge of the metaverse

Knowledge of the metaverse (Did you hear or read about metaverse?)			
–	Knowledge of the metaverse	–	%
	Always	–	1.7
	Many times	–	30.5
	Sometimes	–	59.3
	Never	–	8.5
	Total	–	100

According to the data recorded, 59.3% of graduates have sometimes heard of Metaverse, especially since Mark ZucKerberg decided to change the name of his Facebook network to Meta Platforms

Table 11. Use of metaverse

Have you ever used Metaverse or 3D virtual worlds as a video game, for training or for any other use?			
–	Use of metaverse	–	%
	Always	–	1.7
	Many times	–	5.1
	Sometimes	–	39.0
	Never	–	54.2
	Total	–	100

From the data obtained, it is clear that 54.2% of the graduates have never used Metaverse in education or in any other field

Table 12. Use of metaverse in class

In any of the subjects you study or have studied, has the teacher made use of Metarvese?			
–	Use of Metaverse in class	–	%
	Always	–	0
	Many times	–	1.7
	Sometimes	–	16.9
	Never	–	81.4
	Total	–	100

81.4% of the students confirm that the teacher has never used Metaverse as a methodological resource to teach their subject, probably due to their lack of knowledge about this new emerging methodology

Table 13. Desire to use the metaverse as a learning tool

Would you like to learn in a 3D virtual world or Metaverse, i.e., in a playful environment such as a video game?			
–	Desire to use the metaverse as a learning tool	–	%
	Always	–	27.1
	Many time	–	30.5
	Sometimes	–	40.7
	Never	–	1.7
	Total	–	100

Of the 59 respondents to the survey, 40.7% would sometimes be attracted by the idea of learning with Metaverse, i.e. in a playful environment such as a video game

Table 14. Metaverse improve collaborative methodologies

Do you think that the development of 3D virtual classrooms that are used in the Metaverse as a meeting point between the different worlds where the work guidelines are indicated and the activities to be carried out are collected would improve collaborative learning?			
–	Metaverse improve collaborative methodologies	–	%
	Always	–	25.4
	Many times	–	45.8
	Sometimes	–	23.7
	Never	–	5.1
	Total	–	100

As the results obtained show, 45.8% of the graduates believe that the Metaverse 3D virtual classrooms, as a meeting point between the different worlds where the work guidelines are indicated and the activities to be carried out are collected, would frequently improve collaborative learning

Table 15. Use of avatar to improve students skills

In Metaverse, avatars allow students to: create a character and its role, which enhances their creativity and imagination, develop digital competence, expose the contents in a different and fun way, assume different roles and make decisions taking into account different perspectives and, in addition, present the contents through various channels such as visual or auditory, reaching their peers more easily. Do you agree with this statement?			
–	Use of avatar to improve students' skills	–	%
	Always	–	28.8
	Many times	–	44.1
	Sometimes	–	25.4
	Never	–	1.7
	Total	–	100

44.1% of the graduates say that the avatars used in the Metaveros often allow them to improve their competences

Table 16. Teachers' knowledge of how to use Metaverse as a pedagogical resource

Do you think that teachers in your institution have sufficient knowledge to use Metaverse as a pedagogical resource?			
–	Teachers' knowledge of how to use Metaverse as a pedagogical resource	–	%
	Always	–	5.1
	Many times	–	6.8
	Sometimes	–	52.5
	Never	–	35.6
	Total	–	100

Of the 159 respondents, 52.5% think that teachers in their school sometimes have sufficient knowledge of Metaverse or 3D virtual worlds to use them as a pedagogical resource

Table 17. The use of Metaverse or 3D virtual worlds ensures meaningful learning

Do you think that the use of Metaverse in higher education ensures meaningful learning?			
–	The use of Metaverse or 3D virtual worlds ensures meaningful learning	–	%
	Always	–	16.9
	Many times	–	40.7
	Sometimes	–	37.3
	Never	–	5.1
	Total	–	100

According to the survey results, 40.7% of the 159 students say that Metaverse or three-dimensional worlds in higher education often ensure meaningful learning

Table 18. Metaverse offer more advantages than traditional teaching

Metaverse offer students a number of advantages that face-to-face classes do not: exchange of ideas, more time to process information, freedom to think about what they want to say and then make a contribution and, in addition, easier interaction with teachers through various communication channels. Do you agree with this statement?			
–	Metaverse offer more advantages than traditional teaching	–	%
	Always	–	18.6
	Many times	–	50.9
	Sometimes	–	25.4
	Never	–	5.1
	Total	–	100
50.8% of respondents believe that Metaverse often bring them greater advantages and benefits than traditional teaching			

Table 19. Metaverse improve academic performance

Do you think that using Metaverse in education will help improve academic performance?			
–	Metaverse improve academic performance	–	%
	Always	–	25.4
	Many times	–	52.5
	Sometimes	–	18.6
	Never	–	3.5
	Total	–	100
52.5% of the graduates consider that Metaverse frequently help them to improve their academic performance, which suggests that they associate e-learning methodology as a great option for their studies			

Table 20. Possibility to receive classes through Metaverse

Would you find it interesting if your school offered you the possibility of taking classes through Metaverse when you enrolled at the university?			
–	Possibility to receive classes through Metaverse	–	%
	Always	–	32.2
	Many times	–	42.4
	Sometimes	–	20.3
	Never	–	5.1
	Total	–	100
From the results of this table, it can be seen that 42.4% of the students who took the survey found it interesting that when they enrolled, the University offered them the possibility of receiving classes with Metaverse. Therefore, they show interest in learning by means of another type of methodology than the traditional one			

Table 21. With Metaverse, immersive learning would be worked on like never before

By creating a Metaverse, an educational center can create a campus or a replica of its institution in a virtual version, allowing teachers, students and staff to communicate in an agile way as if they were in person. Do you think that with this alternative, immersive learning could be worked on as never before?			
–	With Metaverse, immersive learning would be worked on like never before	–	%
	Always	–	27.1
	Many times	–	40.7
	Somtimes	–	28.8
	Never	–	3.4
	Total	–	100
40.7% of the graduates think that Metaverse in higher education would often improve immersive learning like never before, which is very significant for this research work			

Table 22. Three-dimensional virtual worlds foster collaborative learning

The Metaverse is defined as the next evolutionary leap of the Internet and communications, do you think that being in constant communication with your classmates or other users will help you in collaborative learning?			
–	Three-dimensional virtual worlds foster collaborative learning	–	%
	Always	–	37.3
	Many times	–	37.3
	Sometimes	–	22
	Never	–	3.4
	Total	–	100

37.3% of the graduates think that they always or frequently use Metaverse to improve their collaborative learning through constant communication with their peers

Table 23. Metaverse help shy students participate in class

Virtual classes in Metaverse are often less intimidating than face-to-face classes, which helps to increase the participation of those students who are more shy. Do you agree with this statement?			
–	Metaverse help shy students participate in class	–	%
	Always	–	23.7
	Many times	–	33.9
	Sometimes	–	35.6
	Never	–	6.8
	Total	–	100

From the results obtained, it is observed that 35.6% of the students surveyed think that sometimes Metaverse virtual classes are less intimidating than face-to-face classes and increase participation

Table 24. Metaverse help to end bullying, intimidation and intolerance in schools

Within the Metaverse there are community norms to achieve an environment based on values such as kindness, inclusion, compassion and respect. Do you think that this methodology would make it easier to end bullying, intimidation or intolerance in schools?			
–	Metaverse help to end bullying, intimidation and intolerance in schools	–	%
	Always	–	16.9
	Many times	–	30.5
	Sometimes	–	37.3
	Never	–	35.6
	Total	–	100

37.3% of the students who took the survey think that sometimes it would be easier to stop bullying, intimidation or intolerance with Metaverse

Table 25. Metaverse are less effective than traditional classes

Do you think that, as a playful methodology, Metaverse are less effective than traditional classes?			
–	Metaverse are less effective than traditional classes	–	%
	Always	–	8.5
	Many times	–	18.6
	Sometimes	–	37.3
	Never	–	35.6
	Total	–	100

According to the results in this table, 37.3% of the students believe that sometimes the Metaverse is less effective than traditional classes because it is a playful methodology. This is probably because they are unaware of the benefits and advantages of gamification and also because they associate the game as a distraction and entertainment

Table 26. Teachers should be trained in Metaverse or 3D virtual worlds

Do you think that teachers should be trained in Metaverse so that they are aware of its advantages and offer it as an alternative in their subject?			
–	Teachers should be trained in Metaverse or 3D virtual worlds	–	%
	Always	–	35.6
	Many times	–	47.4
	Somtimes	–	15.3
	Never	–	1.7
	Total	–	100
47.4% of the graduates believe that teachers should be trained in Metaversus frequently so that they become aware of the advantages it offers and use it as an alternative to explain their subject			

Table 27. With Metaverse I would get the title more easily

"If you were taught through Metaverse it would be much easier for you to get your degree", do you agree with that statement?			
–	With Metaverse I would get the title more easily	–	%
	Always	–	15.3
	Many times	–	3.5
	Sometimes	–	35.6
	Never	–	18.6
	Total	–	100
From the data shown in this table, it can be seen that 35.6% of the graduates think that if they were taught using Metaverse or three-dimensional worlds, it would sometimes be much easier for them to obtain their degree			

Table 28. The use of Metaverse could lead to a better position in the workplace

If pupils or students are at the forefront of technology in the classroom with the use of Metaverse, do you think it will be easier for them to get a better job?			
–	The use of Metaverse could lead to a better position in the workplace	–	%
	Always	–	25.4
	Many times	–	37.3
	Sometimes	–	30.5
	Never	–	6.8
	Total	–	100
37.3% of graduates say that it will often be easier for them to get a better job if they are at the forefront of technology in the classroom through the use of Metaverse			

6. Hypothesis testing

The statistic of significance by excess is Pearson's Chi-square, as it allows us to obtain reliable information with which to accept or reject the hypothesis put forward. In this research, "Metaverse" was taken as the independent variable of the study and "learning and immersion" as the dependent variable.

In order to establish the correspondence of the variables, two questions were chosen from the questionnaire, one for each variable chosen to carry out the combination process.

Question 1

Question 7 was chosen because it refers to the independent variable of study "Metaverse", its wording reads: Have you ever used Metaverse or three-dimensional virtual worlds as a video game, for training or for any other use?

Question 2

Question 17 was chosen because it refers to the dependent variable of study "learning and immersion", whose text is: By creating a Metaverse, an educational center can create a campus or a replica of its institution in a virtual version allowing teachers, students and workers of the center to

communicate in an agile way as if they were in person. Do you think that with this alternative immersive learning would be worked on as never before?

6.1 Approach to the hypotheses

The hypotheses are set out below:

a) Null hypothesis (H0): The application of Metaverse in higher education will not facilitate learning and immersion in graduates.

b) Alternative hypothesis (H1): The application of Metaverse in higher education will facilitate learning and immersion in graduates.

6.2 Selection of the significance level

In order to know whether the Chi-square result was large or small, the critical value was calculated, a reference figure for making the final decision. In this research a significance level of 5% was chosen, i.e. $p = 0.05$.

6.3 Description of the population

We worked with the entire sample, that is, with the 59 university students from the various branches of knowledge and from the different study modalities, to whom we applied a survey about the research that was being carried out.

6.4 Specification of acceptance and rejection regions

In order to decide the acceptance and rejection regions of the hypotheses, the degrees of freedom (V) were first determined, knowing that the square is made up of four columns (c) and two rows (f).

$$V = (f-1) \times (c-1)$$

$$V = (2-1) \times (4-1)$$

$$V = (1) \times (3) = 3$$

After obtaining the degree of freedom equal to 3 and with a significance level of 0.05, we proceeded to search the X^2 distribution table for the critical value (X^2 0.05, 3), whose figure was 7.8147.

Therefore, the null hypothesis would be accepted for any Chi-square value up to 7.8147 and the null hypothesis would be rejected for values greater than 7.8147.

6.5 Data collection and calculation of frequencies

Tables 29 and **30** show the results of the observed and expected frequencies. Likewise, **Table 31** shows the Chi-square result achieved.

Table 29. Observed frequencies

Question	**%**				
	S	**F**	**A**	**N**	**T**
7. Have you ever used Metaverse or 3D virtual worlds as a video game, for training or for any other use?	1.69	5.08	38.98	53.25	100
17. Do you think that with this alternative (Metaverse or 3D virtual worlds) immersive learning would be worked on as never before?	27.11	40.67	28.81	3.41	100

S = Always; F = Many times; A = Sometimes; N = Never; T = total.

Table 30. Expected frequencies

Question	**%**				
	S	**F**	**A**	**N**	**T**
7. Have you ever used Metaverse or 3D virtual worlds as a video game, for training or for any other use?	14.40	22.88	33.89	28.83	100
17. Do you think that with this alternative (Metaverse or 3D virtual worlds) immersive learning would be worked on as never before?	14.40	22.88	33.89	28.83	100

S = Always; F = Many times; A = Sometimes; N = Never; T = total.

Table 31. Chi-square calculation

O	**E**	**(O−E)**	**$(O-E)^2$**	$\frac{\Sigma(O-E)^2}{E}$
1	8.5	−7.5	56.25	6.618
16	8.5	−7.5	56.25	6.618
3	13.5	−10.5	110.25	8.167
24	13.5	10.5	110.25	8.167
23	20	3	9	0.45
17	20	–3	9	0.45
32	17	15	225	13.235
2	17	–15	225	13.235
Chi-square (X^2)				56.94

6.6 Final decision

As mentioned above, the null hypothesis would be accepted for any Chi-square value up to the value 7.8147 and the null hypothesis would be rejected when the values are greater than 7.8147. The obtained Chi-square value is 56.94 which is outside the acceptance region, so the null hypothesis is rejected and therefore the alternative hypothesis is accepted which states: "The application of Metaverse in higher education will facilitate learning and immersion in graduates".

7. Conclusions

From the data obtained in the research it is confirmed that Spanish universities do not make use of Metaverse as a pedagogical resource to improve the process of graduates, therefore, they are unaware of the benefits and advantages offered by this type of technology when applied in the educational world.

Students consider that the implementation of Metaverse in higher education will promote learning and immersion, allowing the development of pedagogical activities in a more innovative and interactive way thanks to its graphical interface.

On the other hand, the results of the survey show that teachers lack the knowledge to make proper use of Metaverse as a pedagogical resource, using only two-dimensional and mainly verbal platforms that only generate a traditionalist and non-interactive learning.

One of the reasons why classes are boring and tedious is the work environment in which graduates develop, which is why it is essential for teachers to create a striking, motivating and motivating environment where students want to work and learn, and to achieve this, they can use Metaverse.

With the use of Metaverse in education, the aim is for students to be the protagonist of their own learning and, in addition, to improve collaborative learning in order to encourage active participation among students through the interaction of avatars within the Metaverse.

With this study we have verified the degree of acceptance of the metaverse in Spanish higher education by both teachers and students. This gives rise to universities and business schools using the metaverse to configure classrooms and make online classes more immersive than a simple connection to a video call. This study should allow higher education institutions to bet on this type of technology and companies to develop EdTech advancing immersion and user experience for both students and teachers.

Conflict of interest

The authors declare no conflict of interest.

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