

VIRTUAL REALITY INTEGRATION IN HIGHER EDUCATION: ANALYZING ITS EFFECTS ON DISTANCE LEARNING STUDENTS

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Abstract

At the onset of the Coronavirus epidemic, the Ministry of National Education, Vocational Training, Higher Education and Scientific Research decided to suspend classes in the various educational institutions, which prompted these institutions to migrate their educational activities to e-learning platforms, but the implementation of this new teaching standard did not meet expectations. In addition, several efforts are being made to improve the quality of distance learning by promoting the use of new technologies, but their integration into pedagogical practices has always been slow. In this context, this research aims to identify the importance of the integration of virtual reality in higher education, and to evaluate their effect on distance learning. To answer our research question, "How the integration of VR in distance learning can improve or not the learning in higher education by adding a new realistic teaching model? We used a quantitative methodological approach, based on based on the collection of data in classes via an online form, for a sample of 106 students. The results showed that most of these students report that distance learning using VR is very rewarding, and it has a positive impact on their learning and attitudes, also, 94.3% of students say that they are aware of the usefulness of VR on their learning, and 83% of them confirmed that VR can become a regular distance learning tool. Therefore, virtual reality as an entertainment tool can be considered an important motivator in remote learning situations, allowing these students to easily enter their learning.

Keywords: Distance Learning, New Technologies, Virtual Reality, VR.

1. INTRODUCTION

Contemporary higher education employs a variety of learning environments, including traditional classrooms, online platforms, and virtual reality settings, to facilitate diverse teaching and learning methodologies such as collaboration, project-based learning, and experiential education. Both physical spaces, like adaptable classrooms and technology-integrated environments, and virtual spaces, such as online forums and video conferencing platforms, cater to different learning preferences [1]. Technology holds promise in enriching educational quality by offering personalized and adaptable learning experiences tailored to individual students' needs. The integration of learning platforms can improve communication and foster greater interactivity among students. Consequently, these aspects have garnered significant attention from researchers,

resulting in numerous published papers exploring learning environments in higher education [1].

1.1 Problematic

In March 2020, face-to-face teaching was suspended due to the spread of COVID 19, the closure of educational institutions led to the immediate halt of all educational activities and the forced migration of all relevant actors to online learning platforms, and by the obligation, Institutions have made a wide range of electronic educational resources available to learners and teachers. Indeed, educational institutions at all levels, engaged in a mode of teaching and training to which they are not accustomed, or which suddenly finds itself applied in exceptional conditions and to several people exceeding the possibilities of the systems in place [2]. This explains this unexpected situation, the use of chat platforms and social networks, to continue the school curriculum, and despite this confusion some institutions have started to set up learning management systems (LMS), and even to acquire new audiovisual materials, with the aim of producing digital content and putting it in the new LMS." In distance learning, the learner often uses educational resources on different media alone in a place that is not a classroom. This place can be their home, the company where they work, a resource center, etc. Educational resources have been produced previously by teachers or specialists who are usually absent from this place at the time. Distance learning therefore implies, by definition, a separation in space and time of teaching and learning activities." [3] This shows that distance learning has become for many learners the new norm for training, it affects all types of training and all levels, not to mention the obstacles found by learners and even teachers in relation to the uses of digital tools, according to [4] they do not have the temporal possibility to become professionals of these tools which drags on learning, On the first hand, it does not allow the teacher to deploy his scenario and, on the other hand, the fact that it promotes the instrumental autonomy of the learners, this pushes us to think about new solutions and technologies that ensure a direct and more realistic teaching.

Given the above, and the need to migrate to new platforms based on virtual reality devices, we can formulate our research problem around the integration of virtual reality in higher education and its impact on students in distance learning.

We take as our object of study students (bachelor's and master's degree) who are following their studies at the Higher Institute of Information and Communication (ISIC) for the academic year: 2023-2024.

1.2 Research question and hypotheses

This situation leads us to ask a central question of our research: "How can the integration of VR in distance learning promote or not the improvement of students in higher education by adding a new realistic teaching model?"

In other words: "What is the impact of the integration of VR on the learning of students in distance learning?"

In addition to this main question, there are other questions that are no less important:

- What is the contribution of virtual reality to the online learning environment?
- What are the benefits for students in terms of using e-learning platforms?
- Is VR integration a more realistic teaching model?
- What is the pedagogical use of these virtual open environments?

To try to answer this question, we put two hypotheses:

The first would be the following: the integration of virtual reality into distance learning could promote the improvement of students learning in higher education, by representing a virtual world that replicates the real world, which would help students to train in real conditions, thus offering a more realistic learning and assessment framework than traditional courses and exams.

The second would be: virtual reality, as a new computer technology being developed, would have no impact on the students learning.

1.3 Research Objectives

Starting from our problematic and its related questions, our research aims to:

Identify the importance of virtual reality and its implication in distance learning and assess its impact on the students learning in higher education, as well as the assets that can promote their learning in a new realistic teaching model.

2. LITERATURE REVIEW

Virtual Reality (VR), a computer-generated simulation of three-dimensional environments, holds significant promise within educational contexts. It empowers students to interact with and delve into complex subjects through immersive, interactive experiences, surpassing the constraints of traditional classrooms [5]. By offering experiential learning opportunities, VR caters to various learning styles appealing to visual, auditory, and kinesthetic learners thus fostering deeper understanding and retention of intricate concepts [6]. [7] Have introduced a pedagogically informed approach to designing teaching and learning spaces. Implemented at McGill University, this approach translates research-backed pedagogical principles into classroom design elements, fostering a cohesive and impactful learning environment. The practical and conceptual ramifications of incorporating these principles have yielded positive effects on the campus.

Improving Student Engagement

In traditional classroom settings, students are typically expected to passively listen and take notes while the instructor delivers the lesson. This approach often leads to low levels of student engagement and limited interaction between students and teachers. Consequently, students may struggle to maintain interest in the subject matter and find it challenging to apply their learning to real-world situations. Oblinger [8] underscores in his

research report that traditional learning spaces are often rigid and lacking in flexibility, with fixed seating arrangements and limited options for reconfiguration. This rigidity can constrain teachers' ability to design activities that require varied seating layouts or specialized equipment setups.

VR technology presents a compelling solution for enhancing student engagement [7]. Unlike traditional lectures and textbooks, which may struggle to sustain student interest, VR captivates learners through immersive experiences, encouraging active participation in the learning process. This active involvement leads to increased motivation, greater participation, and a deeper connection with the material being studied. Moreover, VR empowers educators to create dynamic, multisensory learning experiences tailored to individual learning preferences, thereby enhancing comprehension and retention [6].

Impacts on Learning Results

The influence of VR on learning outcomes is a pivotal subject of investigation. Preliminary research indicates that incorporating VR technology can elevate learning achievements, leading to improved knowledge acquisition and retention [9]. VR's immersive, experiential learning opportunities prove especially beneficial for subjects typically taught through theoretical approaches. Additionally, VR shows potential for personalized learning encounters; adaptable VR environments can customize content and challenge levels to align with each student's requirements, catering to a range of abilities and prior knowledge. This adaptability holds the promise of facilitating more streamlined and impactful learning experiences [10].

3. METHODOLOGY AND DATA COLLECTION

3.1 Methodology

To carry out our research, entitled "Virtual Reality Integration in Higher Education: Analyzing its Effects on Distance Learning Students", and to provide elements of answers to our research question and related questions, to confirm or refute the initial hypotheses, we mainly use experimental research in our research work. This is for the purpose of testing various theories using hypotheses. Thanks to the research and experiments carried out, one can validate or invalidate one's hypotheses by varying certain parameters in one's experiment.

The method of analysis used is quantitative, based on the elaboration of numerical data, covering a well-defined field, it is aimed at students of higher education in general, at certain academic establishments.

Through this experimental study, we demonstrate the potential impact of VR on student performance at the level of e-learning platforms.

The method applied in our study is based on two important parts:

- The demonstration and experience of VR technology, to keep students exploring VR technology and discovering the material appropriate to our pedagogical situation, as well as the different platforms based on virtual reality.
- A data collection through an online form, this survey form is aimed at a representative sample of students at different university levels, it aims to collect data, which concerns the knowledge of these students about VR, its remote use and its importance, as well as the behavior and interaction of these students after the use of VR, their views on understanding, their performance, and their motivations.

3.2 Sample Presentation

In the context of this research, the target population is of course the category of 293 students enrolled at the Higher Institute of Information and Communication (ISIC) for the 2023/2024 academic year. There are 156 undergraduate students and 137 master's students. This population is characterized by different individuals, hence the need to use the sampling technique, while of course respecting the characteristics of the reference population.

Theoretically, our sample is made up of 67 students, or we have adopted stratified probability sampling which allows us to take 36 and 31 students who belong to the bachelor's and master's cycles respectively.

This distribution is chosen in such a way to cover the two cycles, the different age groups, to have an overall idea of the questions addressed in the form, as well as to better verify the hypotheses and objectives of the research.

3.3 Data collection

To achieve our goal, this research requires a good understanding of virtual reality, so that most students can apply the form easily, but the problem that arose was how can the student feel the effect and impact of VR in the classroom?

Indeed, we have targeted six classes (3 classes for each level) with which the lessons will be recorded with 360° cameras to use them in the "demonstration and data collection" part, this means that each class requires two passes (two sessions) for our survey.

We have chosen to use 360° video, because this tool is within the reach of all students and easy to use, and that's why, in the first pass we will put an "insta 360" camera that will be installed on a student's chair with a "Rode wireless go" wireless microphone to ensure a very good quality of our video recordings and that will be published on the YouTube platform privately subsequently.

During the second pass and after a detailed presentation on virtual reality and an explanation of the VR solution that we will make available to students in class, students will have the opportunity to view their lectures via a standalone VR headset from the brand "meta oculus quest" and the YouTube VR application installed in the headset, And to optimize time, we're going to mirror the headset display to a screen or projector, so

everyone in the classroom can see what's happening in virtual reality. Then, with the help of the «Teachers' Lens" application, students will explore virtual classrooms, and put themselves in more realistic situations in real time, giving them interaction functions in this environment.

At the end of this demo part, students will be asked to fill in the online form via a shortened link displayed on the screen or a QR code, which requires providing them with a reliable internet connection source.

Our form consists of 21 questions related to the variables in our research. First, a first section contains 4 questions, which concern personal information, to better identify the student according to the criteria according to gender, age, and university level. Then a second section, which contains 8 questions, it aims to know their knowledge about VR technologies, tools, and how they work, and the third section to show the use of virtual reality in teaching, it contains 2. Then a fourth section contains 5 questions, it shows the impact of virtual reality on students in distance learning, and finally a last section concerns the alternatives of virtual reality, it contains 2 questions.

4. RESULTS

In this part, we will present the results obtained after our survey at ISIC, from which we managed to process a representative sample of 106 students who represent 36% of the target population, composed of 76 undergraduate students (72%), and 30 master's students (28%).

During our survey we managed to record the six planned classes and put them on YouTube, thus setting up a complete VR solution that would help us to demonstrate this technology and collect enough data, and which pushed the students to engage in our survey and answer our questions.



Fig 1: Demo of virtual reality in classroom

In addition, the research questions already mentioned in the problematic inspired the different parts of the questionnaire.

With the anonymity of the form, we extracted candid responses that accurately reflect the students' views.

Virtual reality:

The following tables show the size and percentage of the study sample with knowledge of VR technology:

Table 1: Representation of students who know virtual reality.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	83	78,3	78,3	78,3
	No	5	4,7	4,7	83,0
	More or less	18	17,0	17,0	100,0
	Total	106	100,0	100,0	

The results showed that 78.3% of students know what virtual reality is, so all of these students have concrete ideas about this technology, which can help us analyze the rest of this survey.

Using a VR headset:

The following bar graph shows the size and percentage of the study sample who wore a VR headset:

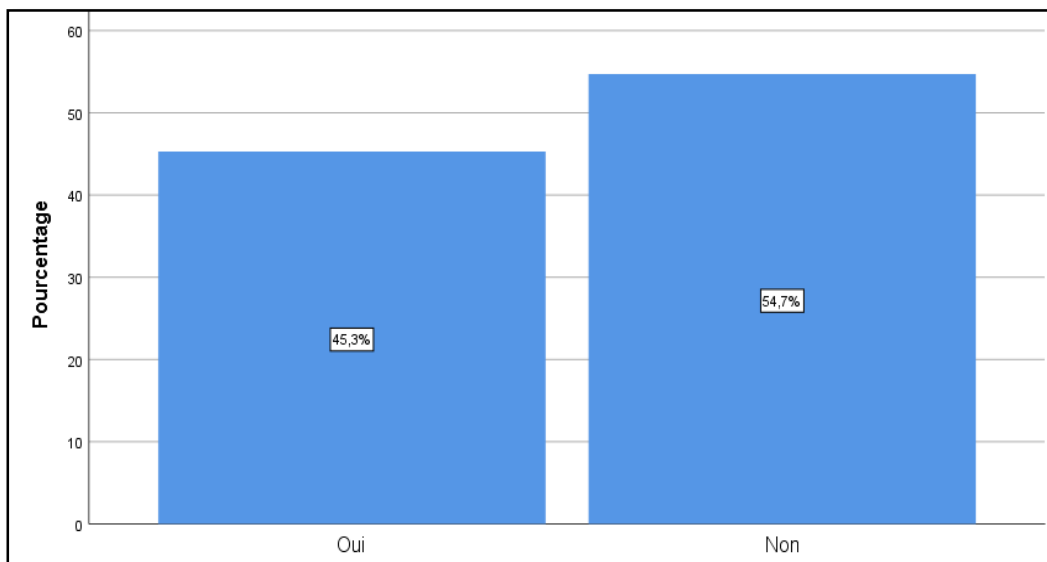


Fig. 2: the percentage of the study sample that wore a VR headset.

For the use of the VR headset, more than 54% of the students have never worn a VR headset this will help us to get an idea regarding the familiarity of the students in our sample with the VR hardware.

How virtual reality works?

The following graph shows the size and percentage of the study sample with knowledge of how VR technology works:

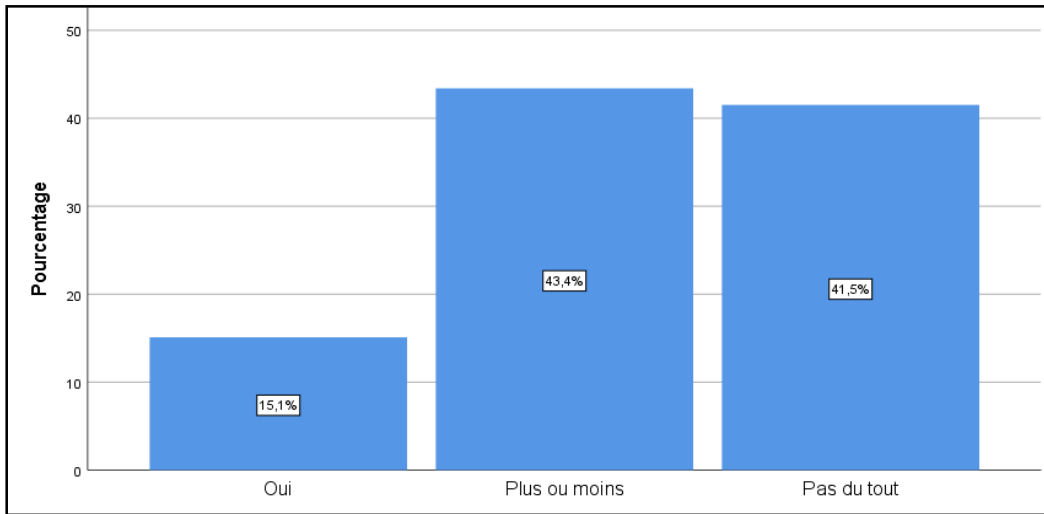


Fig 3: the percentage of the study sample with knowledge of how VR works.

We noticed that only 15% of the students who have any knowledge of how VR works, and on the other hand 43.4% more or less know, and 41.5% of the students have no idea, which shows that more than half of the sample have an idea about how this technology works.

Use of Virtual Reality in Education:

The graph below shows the numbers and percentages of respondents based on their knowledge of institutions that have improved their learning methods using VR technology:

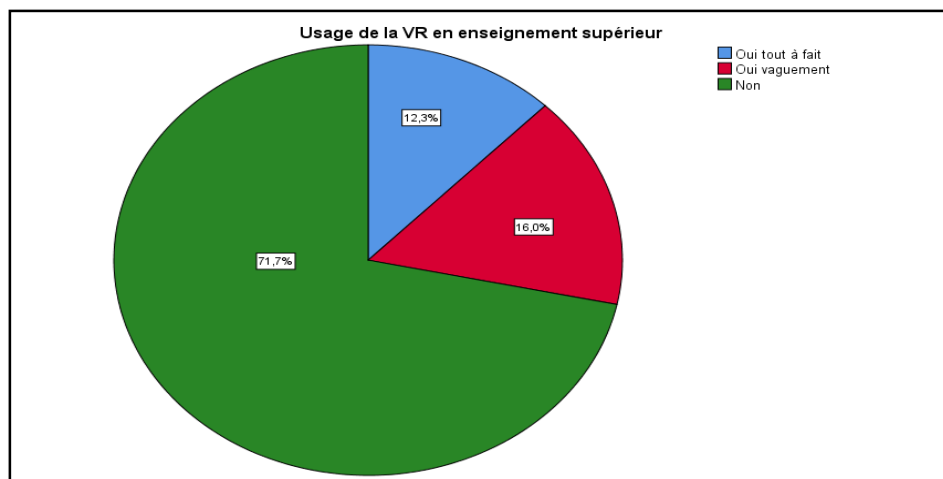


Fig 4: Institutions that have improved their learning methods with VR.

According to the results, we note that 71.7% have no idea about the use of virtual reality in higher education, 16% find it vague, and 12.3% of these students have already heard about the feasibility of VR in education. This means that virtual reality is far from widespread in higher education.

The Impact of Virtual Reality on Distance Learning:

The following pie chart shows how virtual reality can enrich distance learning:

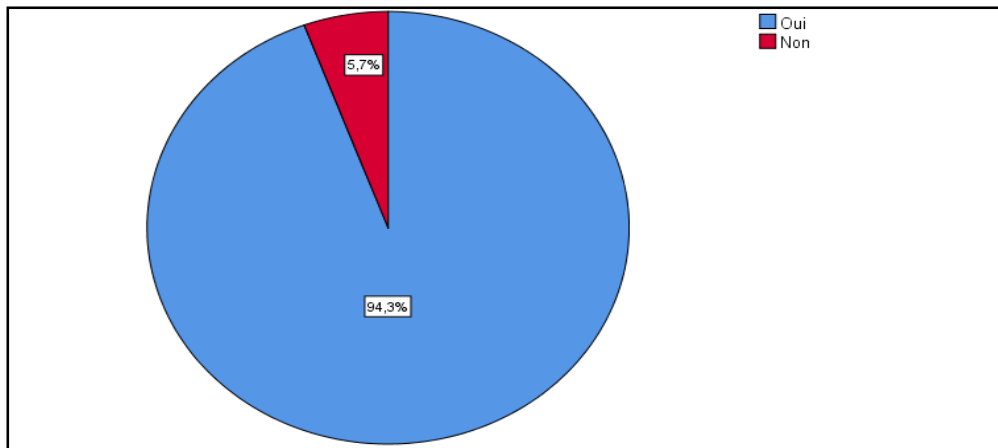


Fig 5: VR's ability to enrich distance learning.

From the graph, we find that 94.3% of respondents, are aware of the usefulness of VR on their distance learning.

Virtual reality as a regular teaching tool:

To show the degree of agreement or disagreement of respondents according to the possibility of VR being a regular teaching tool, we considered the following indicators:

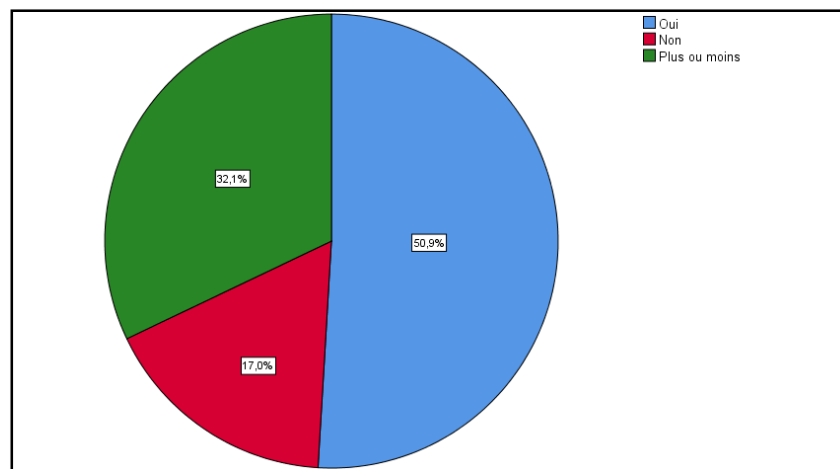


Fig 6: Ability of RV to be a regular teaching tool

We found that 50.9% of students in our sample confirmed that VR can become a regular teaching tool, while 32.1% said they somewhat agreed, however, with 17% of respondents expressing disagreement.

5. DISCUSSION

The objective of our study is to identify the importance of virtual reality and its implication in distance learning, and to assess its impact on students in distance learning, as well as the assets that can promote their learning in a new realistic teaching model. We used the online form as a research tool for students of the two cycles of the Higher Institute of Information and Communication in Rabat, it focuses specifically on the pedagogical integration of virtual reality in higher education, and its contribution on distance learning.

After collecting the data through the form, we conducted statistical analyses to first describe our sample and then to test our hypotheses. First, we started with a descriptive analysis of the sample and the variables in our study, according to the intermediate variables (gender, age, university level), students are: 57.6% girls, while boys represent 42.6%. In terms of the age of the respondents, 76.4% represent students between the ages of 20 and 35, however the age of 20.7% is less than 20 years old, and more than 2% represents students between the ages of 35 and 50. Regarding the percentages of the two cycles, almost 71.7% of students belong to the bachelor's degree, while 28.3% are master's students.

Therefore, this study confirms the positive impact of the integration of virtual reality on students in distance learning in higher education, in fact, the data collected reveals that 94.3% of students say that virtual reality can enrich learning and it could be useful to their institution, as well as 78.3% of the students surveyed. These students have concrete ideas on new technologies (VR, AR, 360° ...), and how they work, including budget estimation. In addition, 71.7% of respondents have no idea about the use of virtual reality in higher education, and 50.9% of students in our sample confirm that VR can become a regular teaching tool, which means that virtual reality is far from widespread in higher education.

Furthermore, 70.8% of respondents do not have concerns about the development of VR, however 20.8% of these students find concerns and expressed them as follows:

- The high cost of hardware and the speed of the internet connection.
- Health & Privacy.
- Accessibility.
- Addiction to this technology.
- The negative impact on communication and human relations.

As well as 95.3% believe that 360° video would be an alternative solution in the event of VR inaccessibility, and 34.9% strongly agree. So, the results of our research allow us to distinguish these main findings:

- The first observation concerns the integration of virtual reality, this integration remains limited in higher education, VR solutions dedicated to teaching remain expensive and out of reach of students, so the efforts made to generalize it are not sufficient.
- The second observation drawn from this study is that most students confirm that virtual reality changes their learning interest, and that it gives them a sense of commitment to their distance learning, as well as expressing their desire to generalize it.
- The third observation we notice is that a large part of the professors are not ready to be engaged in e-learning solutions, as soon as they have managed to use the video projectors, even if some universities in Morocco have invested in these solutions, which means that these professors profess to teach with classical methods in the classroom.

Finally, the use of virtual reality for distance learning should not be perceived as an optional activity, to be done only to waste time, as well as a motivation of the teaching staff on the use of VR in their pedagogical practices becomes necessary to improve distance learning.

6. CONCLUSION

Through this research, we highlighted the integration of virtual reality in higher education and their impact on students in distance learning through field research that we conducted in a sample of 106 students, but although our sample size is not very large, the students who answered our questions provided us with a number of elements that allowed us to shed light on the above analysis.

In this work, we found that the use of virtual reality makes remote teaching more realistic, easier for students to interact, it gives them the desire to learn, the desire to discover new knowledge, and to carry out research, as well as the use of VR. Moreover, students in the case of distance learning have a high sense of self-efficacy thanks to the use of virtual reality because it allows them to promote their autonomy, it helps them to develop their digital skills, to promote the development of their creativity, to learn in a personalized way, and to make learning collaborative.

Also, this research shows that VR is an important motivating element in student learning, and a pedagogical tool used in the context of online courses to activate the student's knowledge, know-how, and interpersonal skills to facilitate learning and the construction of new knowledge, which allows these students to easily enter into their learning and subsequently improve their academic results and obtain good results.

The results obtained verify the first hypothesis and answer our question concerning the integration of virtual reality in higher education and its impact on distance learning students.

We aim to further this endeavor through a market study of VR applications that could be utilized in engineering education, by conducting a survey among educators and students in these disciplines at Moroccan universities. The objective is to investigate their comprehension, expectations, and potential barriers to the integration of these technologies into Moroccan higher education curricula.

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