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Statistical Analysis of Professors' Assessment Regarding the Didactic Use of Virtual Reality: Engineering vs. Health

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Abstract: Virtual reality (VR) has proven to be an efficient didactic resource in higher education after the pandemic caused by COVID-19, mainly in the Engineering and Health Sciences degrees. In this work, quantitative research is carried out on the assessments made by Latin American professors of Health Sciences and Engineering of the didactic use of VR. Specifically, the gaps by university tenure in the assessments given by the professors of each of the two areas of knowledge analyzed are identified. For this purpose, a validated questionnaire has been used, which has been applied to a sample of 606 professors. As a result, it is shown that the professors of Engineering and Health Sciences have similar self-concepts of their digital competence, but the Engineering professors give higher values to the technical and didactic aspects of VR. Moreover, in both areas, professors from private universities rate VR technologies more highly than those from public universities, this gap being wider in Health Sciences. Finally, some recommendations are offered regarding digital training and the use of VR, derived from the results of this study.

Keywords: virtual reality; learning; engineering; Health 4.0; didactic resource; university tenure

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1. Introduction

1.1. Presentation and Literature Review

In the post-COVID-19 scenario, the teaching–learning process has a high specific weight of technology. Information and communication technologies (ICT) were positioned as an effective solution for coping with the situation of global confinement suffered from March 2020 to 2022 [1]. Currently, they are considered fundamental for making the teaching–learning process more effective and motivating for both teachers and students [2–4]. One of the ICTs currently considered relevant is virtual reality (VR) [5]. VR is defined as a computer-generated environment in which the user, in combination with different technologies and devices, can perform multiple actions [6]. This technology was created in 1960 [6], although it was in 1986 when Jaron Lamier first used the term for a collection of technological devices [7].

VR is an advanced human–computer interface that simulates a realistic environment by creating a 3D digital world and allows the users to experience an immersive environment with which they can interact [8,9]. Among the multiple actions that users can perform in VR applications, the following are worth highlighting: the displacement through the scenario, the vision in different angles, and the possibility of reaching, grabbing, and reshaping objects [10]. Moreover, VR is a human-created technology that can be used as a scientific method to better understand, simulate, adapt, and use nature [11].

The use of VR has become widespread since the pandemic situation of COVID-19 [12–17] because it can be effectively employed to solve or address many of today's problems such as providing useful learning in engineering [18–21] and health [22–24]. Among the characteristics of VR as a didactic method, the following are worth highlighting (Figure 1): (i) the multiple cognitive and pedagogical benefits, which allow the improvement of students' understanding of subjects, performance, grades, and the educational experience [25]; (ii) the improvement of students' ability to analyze problems and explore new concepts [8]; (iii) the multitude of scenarios that can be developed; (iv) the high capacity for interaction [26]; and (v) the ease of learning offered by the technology [8].

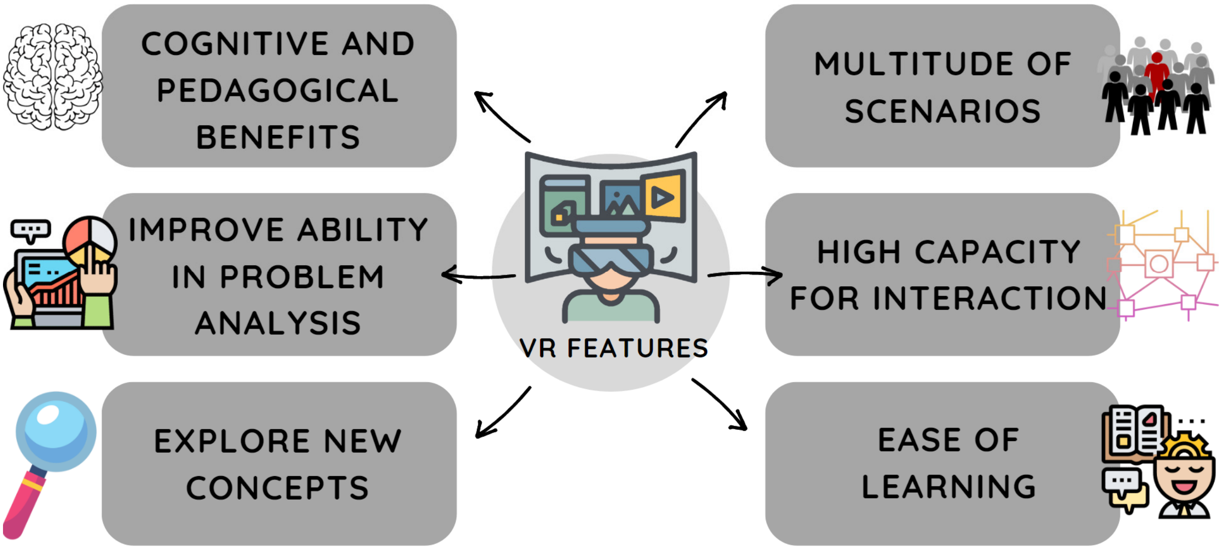

Figure 1. VR features as a didactic resource.

In the case of Engineering, VR has proven to be an efficient didactic resource used in numerous fields due to the possibility it offers to generate environments that simulate complex geometric models. Some of the uses of this technology are: (i) virtual laboratories [27–29] or certain specific environments in construction, manufacturing, electricity, etc. [30,31]; (ii) construction projects [32–34]; (iii) manufacturing processes [35]; (iv) 3D visualization in navigation fields [36]; (v) automotive manufacturing [37]; and (vi) interior design [38,39]. The application of VR in Engineering provides students with the opportunity to visualize the engineering concepts they learn in the classroom [40]. This resource is considered more effective than traditional methodologies because it enables students to interpret their virtual experiences and integrate them with existing memories to build new knowledge [41].

However, it should be noted that the uses of virtual environments would not have added pedagogical value if the immersive experience distracts from the learning task [18]. In recent decades, the use of VR for pedagogical applications in educational environments has become increasingly popular in Engineering due to its competencies, as follows: (i) helping to increase motivation; (ii) enrichment of learning experiences [18]; (iii) providing a realistic sense of presence in the virtual design environment [42]; (iv) providing a safe, immersive, and realistic experience for users; and (v) cost reduction [43].

Regarding healthcare, some studies already predicted that VR would have a major impact on healthcare in the next decade [44] because it is a very cost-effective approach that allows medical students to identify and minimize errors occurring at any stage [45]. This use of VR offers two key advantages: (i) its integration of all the different methods (cognitive, behavioral, and experiential) commonly used in the treatment of body experience disorders within a single virtual experience; and (ii) its utilization to induce the patient into a controlled sensory reordering that unconsciously modifies his or her body awareness (body schema) [7].

VR has recently emerged as a potentially effective way to deliver general and specialized health care services such as for the treatment of phobias as it offers several advantages over live exposure: it can be administered in traditional therapeutic settings and is more controlled and cost-effective. This technology is also being used in (i) surgery using image-guided simulators and neurosurgery using augmented reality, (ii) mental health [9] and anesthesia [22], (iii) stroke rehabilitation as it potentially improves functional recovery outcomes [46,47], (iv) comprehensive rehabilitation [44,48], (v) anger management [49], (vi) surgical training and orthopedic training programs [50], and (vii) various diseases [45].

A simple indicator of the growing use of VR in Engineering and Health is the number of research articles that include the term VR as the subject of the research. From a simple SCOPUS query of the number of articles that include in the title, abstract, or keyword (data collected in February 2023) the following search criteria—(i) "Virtual Reality" AND "Engineering" AND "Education"; and (ii) "Virtual Reality" AND "Health" AND "Education"—Figure 2 was obtained. Between 1998 and 2022, a total of 3983 articles in the SCOPUS database include "Virtual Reality" AND "Engineering" AND "Education" in the title, abstract, or keywords. In the case of the search "Virtual Reality" AND "Health" AND "Education", there were 2197 published articles in the same period.

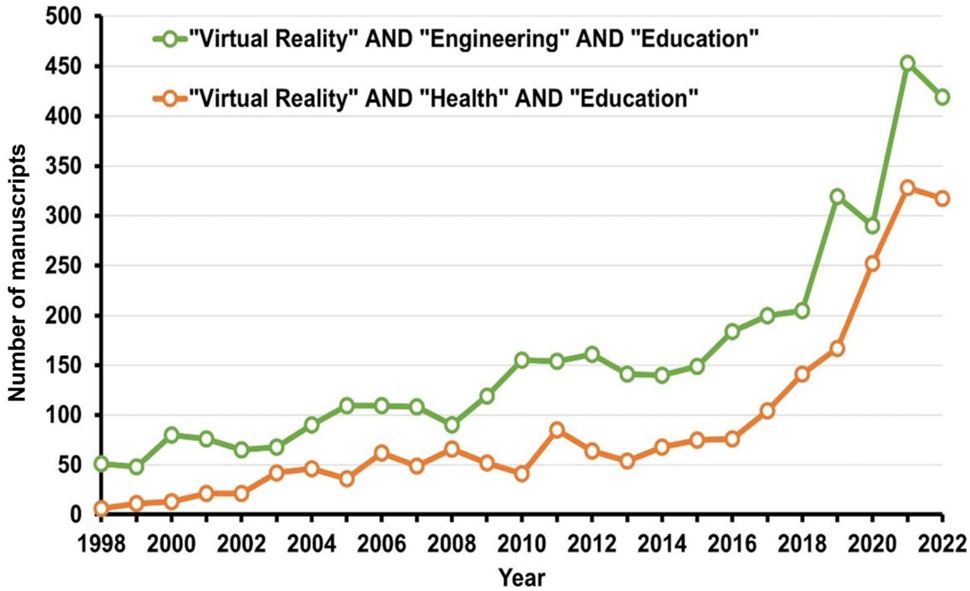

Figure 2. Number of research papers indexed in SCOPUS (data collected in February 2023).

In 2008, the number of articles in the SCOPUS database that met these search criteria was less than 100, and in the case of Health, the number of published articles was even lower than 70. However, in 2022, the number of published articles that meet the search criteria "Virtual Reality" AND "Engineering" AND "Education" is more than 400.

Similarly, in the case of the search for "Virtual Reality" AND "Health" AND "Education", since 2021, the number of articles published has exceeded 300, which represents a threefold increase in the scientific community's interest in research in this area compared to 2008. It is worth noting that, in both searches, from 2018 to 2021, the number of published articles meeting both search criteria has doubled. These data show that the pandemic originated by COVID-19 at the end of 2019 has led to an increase of interest by the scientific community in the research of educational applications of VR in both Engineering and Education.

Online learning and VR were present in classrooms before COVID-19 [51–53], but in the current educational paradigm, [54,55] these technologies represent an alternative to traditional learning by providing students with regularly updated information. This pandemic has successfully forced online learning as a platform in higher education institutions. A shift was made from a conventional learning system to online learning, reaching an educational transformation in terms of technological modernization and digitization [56]. Along with this multimodal pedagogical shift, there is increasing evidence that simulation improves competence, attitude, and behavior compared to traditional didactic methods [57].

The literature has identified variables that condition teachers' perceptions of the didactic use of VR technologies, such as the area of knowledge in which they are experts [58].

In this sense, the highest ratings have been identified among teachers who, in principle, have a deeper technological training (professors of technical areas) and among those who, a priori, would have less technological training, based on their academic specialization (professors of Humanities) [58]. Within the different areas of knowledge, other explanatory variables of digital competence or perceptions about the use of digital technologies have also been identified, such as the age of the professors [58–62]. In this sense, it has been shown that there is a mismatch between the digital demands that newly qualified teachers meet in their profession and the training in the use of educational technology provided during teacher training [63,64].

Some studies have analyzed the opinion of professors in private universities [65] or public universities [66] on the application of VR, all agreeing on the benefits of VR as a teaching resource, but none of them compares the opinion of professors in public and private universities. The analysis of teaching expenses and costs indicates that public universities spend more on classrooms and libraries, while private universities spend more on laboratories and ICT [67]. However, ICT, including VR, is one of the components considered by the literature as basic in the performance of innovation in universities, regardless of their tenure [68]. Furthermore, despite the differences that exist between private and public universities in terms of the integration of digital technologies, there are no studies that address in depth the gaps by university tenure in the assessments of professors in relation to the use of these technologies in teaching activities. For this reason, this paper analyzes the assessments made by professors in the areas of Engineering and Health Sciences about the didactic use of VR technologies, to identify the gaps that exist between private and public universities in this regard.

1.2. Research Objectives

Given this context, characterized by the emergence of VR as a didactic tool and its capacity to enhance innovation in any university ecosystem, the general objective of this study is to analyze the assessments made by Latin American professors of Health Sciences and Engineering on the didactic use of VR in higher education and to identify the gaps by university tenure in these assessments in each of the areas of knowledge analyzed. This general objective is specified in the following specific objectives: (i) to analyze the differences between the assessments that professors of Health Sciences and Engineering of Latin American universities make of VR; (ii) to study whether there are gaps by the university tenure of the participating professors in the assessments expressed of VR by professors in each of the two areas of knowledge analyzed (Health Sciences and Engineering); and (iii) to check if there are differences between Health Sciences professors and Engineering professors in terms of the behavior of the university tenure gaps in the ratings expressed on the VR.

2. Materials and Methods

2.1. Participants

The study involved 606 professors (52.64% females and 47.36% males) from Health Sciences and Engineering degrees from different universities in the Latin American and Caribbean region (Figure 3).

The criteria for inclusion in the study were as follows: (i) being an active professor at a university in the Latin American and Caribbean region; (ii) being a specialist in Health Sciences or Engineering and teaching in a degree program in the corresponding area of knowledge; and (iii) having attended a training session on the didactic use of VR technologies given by the authors. This training session was repeated every two weeks by the authors between January and June 2022 with the following objectives: (i) to present the basic technical concepts of VR and its didactic employability in higher education; (ii) to show practical applications of the use of VR as a didactic resource in Health Sciences education and Engineering education. During the training, therefore, various applications of VR in higher education in the areas of Engineering and Health

Sciences were presented. In this sense, different examples of both immersive virtual reality (IVR) and non-immersive virtual reality (NIVR) were shown to the audience. Attendance at this training session guaranteed that the participants had sufficient and homogeneous knowledge about VR at the time of answering the questionnaire that was used as a research instrument. Participation was voluntary, free, and anonymous, without collecting data that could identify the participant, and the indications of the Declaration of Helsinki were always respected. In total, 624 professors responded to the survey, of which 606 responses were considered valid, in the sense that they were complete and met all the inclusion criteria.

Figure 3. Participant countries.

Among the participants, 50.5% (a total of 306) are professors of Health Sciences, while 49.5% (a total of 300) are professors of Engineering. Therefore, the distribution of participants by areas of knowledge is homogeneous (chi-square = 0.06, *p*-value = 0.8079). Moreover, 42.08% (a total of 255) of the participants work in private universities, compared to 57.92% (a total of 351) who work in public universities, which implies that there is a certain bias in the distribution of the participants by university tenure (chi-square = 15.21, *p*-value = 0.0001). This slight superiority of the proportion of participants from public universities is realized in the two areas of knowledge analyzed (Figure 4) in an approximately homogeneous way (chi-square = 0.28, *p*-value = 0.5941).

2.2. Research Variables

In this study, the area of knowledge is considered as the main explanatory variable, which is nominal dichotomous with possible values Health Sciences and Engineering. The secondary explanatory variable is the university tenure of the participants, which is also nominal dichotomous, with possible values of private or public. The explanatory variables are the participants' ratings of the following aspects of VR: (i) self-concept of digital skills for the use of VR; (ii) technical aspects of VR (in terms of realism, three-dimensional design, and immersiveness); (iii) usability (referring to the assessment of user experience, interaction, and its employability in the classroom); (iv) degree of disadvantages of VR as a didactic resource in higher education; (v) future projection attributed to VR as a didactic resource; and (vi) didactic aspects of VR (didactic usefulness, induced motivation, degree of acceptance by the students, influence on the smooth running of the class, viability for implementation in the university, and influence on the academic performance of the students). All variables were measured on a Likert scale from 1 to 5 where 1 means null rating, 2 is low, 3 is medium, 4 is high, and 5 is very high.

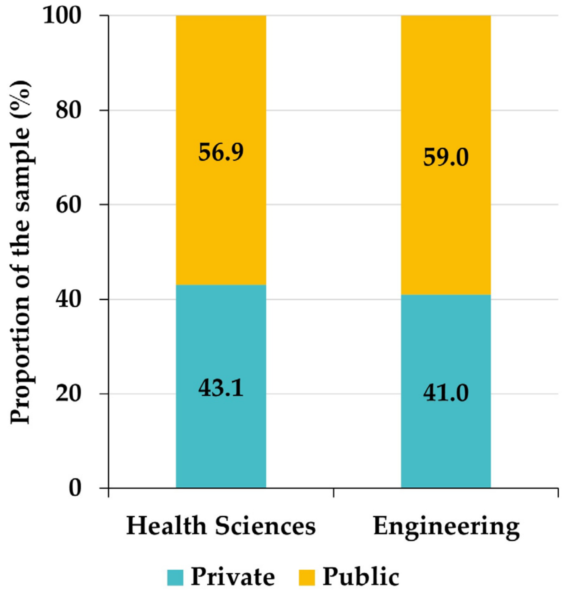

Figure 4. Distribution of participants by area of knowledge and university tenure.

2.3. Research Instrument

The research instrument used is a validated questionnaire on university professors' assessment of VR technologies [69]. The questionnaire consists of 22 questions and the factor analysis shows that they are distributed in six families of questions, which correspond exactly to the six explained variables considered in the present study: (i) self-concept of digital skills for the use of VR technologies (questions 1 to 3, on general digital skills, knowledge of VR technologies, and training received in this regard); (ii) assessment of the technical aspects of VR (questions 4 to 6, on realism, immersiveness, and 3D design); (iii) assessment of the usability aspects of VR (questions 7 to 9, on user experience, interaction, and ease of use); (iv) assessment of the disadvantages of VR (questions 10 to 14, on costs, space limitations, technical and human resource requirements, training requirements for professors, and technological obsolescence of the equipment); (v) future projection attributed to VR as a teaching resource in higher education (questions 15 and 16, referring to IVR and NIVR); and (vi) evaluation of the didactic aspects of VR (questions 17 to 22, on student motivation, influence on the development of classes, increase in academic performance, student acceptance, didactic usefulness, and the university's capacity to incorporate these technologies).

The confirmatory factor analysis statistics computed confirm the theoretical model defined and validated by the factor analysis. Indeed, the incremental fit indices are appropriate (AGFI = 0.8439; NFI = 0.8235; TLI = 0.7961; CFI = 0.8448; and IFI = 0.8463), and the absolute fit indices are also good (GFI = 0.8036; RMSEA = 0.1157; AIC = 1868.22; and chi-square/df = 7.0218). The internal consistency of the theoretical model is confirmed by Cronbach's alpha and composite reliability parameters since all of these parameters are greater than 0.7 (Table 1).

2.4. Statistical Analysis

This work consists of quantitative research on the assessments made by Latin American professors of Health Sciences and Engineering about the didactic use of VR technologies in higher education. Descriptive statistics were obtained for the responses to the different families of questions. Bilateral t-tests for independent samples were applied to test the hypotheses of equality of mean ratings for each of the families of questions between the Health Sciences and Engineering professors. Likewise, the Levene's test of variance comparison was applied to test the hypotheses of equality of standard deviations in the answers of the professors of the two areas of knowledge. The Pearson correlations of all the pairs of families of professors' responses in each of the areas of knowledge analyzed were computed to analyze the influence exerted by some variables explained in the rest, among the professors of each area. Finally, to compare the responses of the professors of private and public universities, the ANOVA test was used among the professors of each area of knowledge and the multifactor ANOVA test (MANOVA) was applied to analyze whether the behavior of the gaps by university tenure in the responses behaves in the same way or not in the two areas of knowledge. A significance level of 0.05 was used in all hypothesis tests.

Table 1. Cronbach's alpha and composite reliability (CR) parameters of the responses to the different families of questions identified by the factor analysis.

Factor	Cronbach's Alpha	CR
Digital skills	0.7108	0.7001
Technical aspects	0.8352	0.8193
Usability of VR	0.7723	0.7212
Disadvantages of VR	0.7607	0.7208
Future projection	0.7339	0.7223
Didactic aspects	0.8320	0.8107

3. Results

There are only significant differences between Health Sciences and Engineering professors in the ratings of the technical and usability dimensions of VR, in which Engineering professors give better ratings than Health Sciences professors (Table 2). In the rest of the dimensions, there are no significant differences between the professors of the areas analyzed. In particular, the professors of the two areas give high ratings (above 4 out of 5) to the didactic dimensions of VR and intermediate ratings (between 3 and 4 out of 5) to the disadvantages of VR and to the future projection of its use, but there are no significant differences between the two areas of knowledge, nor are there differences between the self-concepts of digital competence for the use of VR, which is low in any case (below 3 out of 5), even though, predictably, Engineering professors should have, due to their training, a higher level of digital skills (Table 2). Although no significant differences were identified between the self-concepts of digital skills among Engineering and Health Sciences professors, there are greater differences in this regard among Engineering professors, since the standard deviation is higher (1.27 vs. 1.18 out of 5), and the difference is statistically significant (Table 3).

Table 2. Mean values and bilateral t-test statistics for independent samples with Welch's correction, without assuming equality of variances, differentiating by areas of knowledge.

Factor	Mean (Out of 5) Health Sciences	Mean (Out of 5) Engineering	*t*-Statistic	*p*-Value
Digital skills	2.77	2.74	0.59	0.5539
Technical aspects	3.88	4.18	−6.77	<0.0001 *
Usability of VR	4.15	4.26	−2.76	0.0059 *
Disadvantages of VR	3.58	3.57	0.12	0.9019
Future projection	3.96	3.85	1.94	0.0527
Didactic aspects	4.11	4.15	−1.12	0.2610

* *p*-value < 0.05.

Table 3. Standard deviations and statistics of Levene's test of variance comparison, differentiating by areas of knowledge.

Factor	Std. Deviation (Out of 5) Health Sciences	Std. Deviation (Out of 5) Engineering	Levene *F*	*p*-Value
Digital skills	1.18	1.27	12.35	0.0005 *
Technical aspects	1.03	0.87	27.02	<0.0001 *
Usability of VR	0.86	0.90	12.02	0.0005 *
Disadvantages of VR	1.32	1.24	26.77	<0.0001 *
Future projection	0.93	1.05	12.70	0.0004 *
Didactic aspects	1.02	1.01	13.20	0.0003 *

* p-value < 0.05.

The influence that the self-concept of digital skills exerts on the assessments of the different dimensions of VR differs between Health Sciences and Engineering professors. Indeed, among Health Sciences professors, the self-concept of digital competence positively and significantly influences the assessment of the usability and didactic aspects of VR, while among Engineering professors, it does so on the assessments of the usability, disadvantages, and future projection of VR (Tables 4 and 5). Likewise, the Health Sciences professors' assessment of the didactic aspects of VR is positively influenced by the assessment of the technical aspects, while this influence is not observed among the Engineering professors (Tables 4 and 5).

Table 4. Pearson correlations between the responses of the different families of questions, among the Health Sciences professors, with indication of those correlations that are statistically significant.

	Competence	Technical	Usability	Disadvantages	Future	Didactic
Competence	1	–0.0918	0.1986 *	0.0770	0.0321	0.1603 *
Technical		1	0.5565 *	0.0439	0.2804 *	0.3045 *
Usability			1	0.1338 *	0.3847 *	0.3438
Disadvantages				1	0.0173	–0.2689 *
Future					1	0.2146
Didactic						1

* p-value < 0.05.

ANOVA tests show that, among both Health Sciences and Engineering professors, there are significant gaps in the ratings of the usability aspects of VR and the didactic aspects of its use. Specifically, professors from private universities give higher ratings to VR technologies in both aspects and in both areas of knowledge (Table 6). However, the statistics of the multifactor ANOVA test prove that the behavior of the gaps by university tenure in the above ratings are different among the professors of the two areas of knowledge analyzed. Specifically, the gap in terms of the ratings of the usability dimensions of VR is significantly larger in Engineering (the ratings of professors from private universities exceed by 10.8%) than in Health Sciences (the corresponding difference is 4.7%). On the other hand, the gap in the ratings of the didactic aspects of VR is greater in Health Sciences (the superiority of the ratings of professors from private universities over public universities reaches 8.3%) than in Engineering (the distance is 2.4%).

Table 5. Pearson correlations between the responses of the different families of questions, among the Engineering professors, with indication of those correlations that are statistically significant.

	Competence	Technical	Usability	Disadvantages	Future	Didactic
Competence	1	−0.0250	0.1181 *	0.1554 *	0.1785 *	−0.0808
Technical		1	0.2500 *	0.0501	0.2574 *	0.0293
Usability			1	0.1980 *	0.2854 *	0.0951
Disadvantages				1	0.1018 *	−0.3080 *
Future					1	0.0077
Didactic						1

* *p*-value < 0.05.

Table 6. Mean ratings and statistics of the MANOVA test distinguishing by area of knowledge and by university tenure.

	Health		Engineering		MANOVA *F*	*p*-Value
	Private	Public	Private	Public		
Competence	2.85	2.71	2.71	2.75	2.17	0.1412
Technical	3.91	3.85	4.22	4.15	0.03	0.8526
Usability	4.26	4.07	4.52	4.08	9.17	0.0025 *
Disadvantages	3.63	3.54	3.70	3.49	1.87	0.1716
Future	3.89	4.02	3.87	3.84	1.86	0.1726
Didactic	4.30	3.97	4.21	4.11	11.45	0.0007 *

* *p*-value < 0.05.

4. Discussion

The results show that Engineering professors give higher ratings to the technical aspects of VR (Table 2) and that their responses in this respect are more homogeneous than those of Health Sciences professors (Table 3). This is, to a certain extent, to be expected, due to the predictably better technical and digital training of the Engineering professors. However, as a novelty contributed by the present study, it has been found that this gap does not lead to the existence of significant differences in the assessment of the employability and teaching effectiveness of VR technologies among professors in the two areas analyzed (Table 2). In both cases, the ratings of the didactic use of VR are high, which shows that the professors agree with the didactic benefits attributed to these technologies in the literature, both in the Engineering [40,41] and Health Sciences [7,8,25] areas. In addition, among Health Sciences professors, the assessments of the didactic aspects of VR are influenced by multiple factors, such as their self-concept of digital competence, the technical aspects of VR, or the disadvantages they find in its use (Table 4). In contrast, Engineering professors' assessment of the didactic aspects of VR is only influenced by the economic, training, and space disadvantages they perceive in this type of technology for its implementation in the classroom (Table 5). The previous literature highlights that universities (mainly public universities) understand that the costs of implementing VR technologies are a major inconvenience for their integration in higher education [67]. However, the specialized literature has shown that the implementation of these technologies has a long-term cost-saving effect for universities [43,45].

The above results are partially in agreement with the previous literature. In general, it has been found that Engineering professors give very high ratings to the didactic use of VR technologies [31]. However, some studies carried out in the same geographical region show that professors in areas, in principle, far removed from the use of digital technologies, such as Humanities, report higher ratings of VR than Engineering professors [58]. From this, we conclude that there must be academic factors other than digital competence that are conditioning the differences in professors' perceptions of VR according to their respective areas of knowledge. The problem of identifying these new factors suggests the need for a qualitative analysis complementary to the results presented here.

Although no significant differences were identified between the two areas of knowledge in the evaluations of the didactic dimensions of VR, gaps were identified in this regard between public and private universities and, moreover, these gaps do not behave in the same way in one area and the other (Table 6). Specifically, professors from private universities give, in both areas of knowledge, better ratings to VR technologies, both from a technical, usability, and didactic point of view, as well as from the point of view of the future projection attributed to them, than professors from public universities. However, as regards the assessment of didactic aspects, this gap is significantly wider (more than three times wider) among Health Sciences professors than among Engineering professors. In fact, the superiority of the ratings of Health Sciences professors from private universities over those from public universities reaches 8.3%, while among Engineering professors, this gap is only 2.4% (Figure 5).

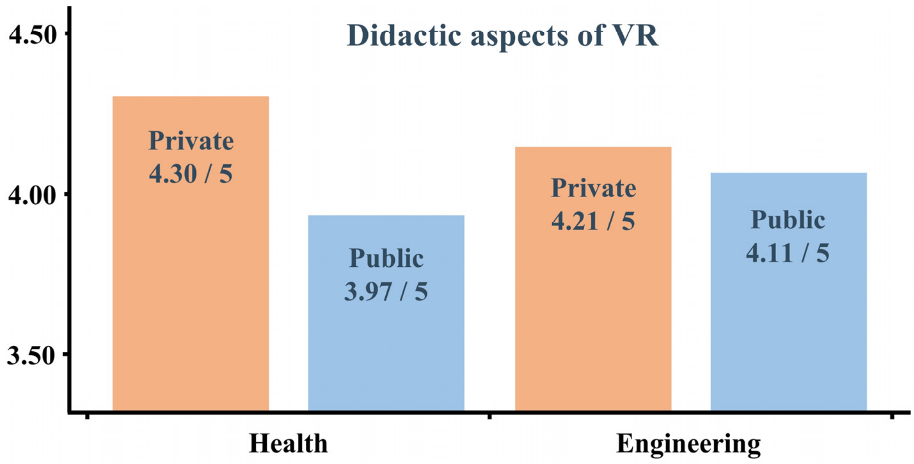

Figure 5. Didactic aspects of VR (rating out of 5).

Indeed, the literature had already identified that the high ratings attributed by professors to VR occur in both private [65] and public [66] universities. The existence of gaps in the ratings of VR according to the university tenure of the professors within a given area of knowledge had also been identified, such as in Health Sciences, where the superiority of these ratings among professors from private versus public universities was found [57], and had been attributed to the greater investment that, in general, private universities in the region make in digitization compared to public centers [67]. However, the comparison between these gaps by university tenure is an aspect that previous literature had not addressed, as far as it has been possible to explore, so that the above results constitute an original and novel contribution of the present research.

The following are proposed as lines of future research:

- To carry out an analogous study seeking homogeneous distributions by areas of knowledge and university tenure, in order to contrast the results obtained here;
- To extend the study by incorporating diverse areas of knowledge, with the aim of obtaining a more general overview of the influence of the area of knowledge on the behavior of the gaps by university tenure analyzed;
- Quantitatively analyze the influence of the age of the participants on the assessments given on the VR, both in the areas of knowledge analyzed and in other areas of knowledge;
- To extend the analysis to other regions, in order to study the dependence of the results on the geographic variable;
- To complete the results obtained here with a qualitative analysis that will allow us to identify the underlying reasons for the gaps identified.

5. Conclusions

Latin American Engineering professors have similar self-concepts of their digital competence for the use of VR as their Health Sciences colleagues, but these self-concepts are more heterogeneous among them than among Health Sciences professors. However, the self-concept of digital competence influences the ratings of VR differently among Latin American Engineering and Health Sciences professors. Among Health Sciences professors, it slightly influences the evaluation of the didactic and usability aspects of VR, while in Engineering, it influences the evaluations of usability, the future projection of VR, and the disadvantages of its use in the classroom. Engineering professors in Latin America rate the technical aspects of VR 7.7% higher than Health Sciences professors and the usability aspects 2.7% higher than Health Sciences professors. In contrast, the ratings of the didactic aspects of VR are high in both areas of knowledge and no significant differences are identified between them. Furthermore, among Latin American Health Sciences professors, the ratings of the technical and usability aspects of VR influence their ratings of the didactic aspects, while among Latin American Engineering professors, the ratings of the technical and didactic dimensions of VR are independent.

Among Latin American professors in the two areas of knowledge considered, there are gaps between private and public universities in terms of their assessment of the didactic and usability aspects of VR. However, these gaps behave differently depending on whether the professors are in Health Sciences or Engineering. Although in both areas, the ratings of professors from private universities are better than those of professors from public universities, with respect to the usability aspects, this superiority is 4.7% in Health Sciences and 10.8% in Engineering, and in the ratings of the didactic aspects, it is 8.3% in Health Sciences and 2.4% in Engineering. Consequently, the gap between private and public universities is more pronounced in the area of Health Sciences with respect to the evaluation of usability and in Engineering with respect to the evaluation of didactic aspects.

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