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Training effectiveness with virtual reality technology: impact on insurance sales in the banking industry

Belén Díaz Díaz[a], Rebeca García-Ramos[a] and Sandro Arrufat-Martín[b]

[a]Dpto. Administración de Empresas, University of Cantabria & SANFI, Santander, Spain; [b]Departamento de Comunicación Audiovisual y Publicidad, Universidad Rey Juan Carlos, Fuenlabrada, Spain

ABSTRACT

Although previous studies have established a solid foundation for virtual reality (VR)-based training, they have not focused specifically on its application in banking or its impact on outcomes. To address these shortcomings, this research aims to analyse the effectiveness with VR technology, and specifically, its impact on insurance sales in the banking industry. The research will also report what kind of user values the VR-based training best or who is most successful in the training. We have run a nonparametric analysis and a regression analysis considering training and business indicators, as well as variables that measure employees' characteristics, bank office characteristics and location. Our findings show that the success in VR training, proxied by the percentage of questions correctly answered in the training, and employees' satisfaction with the VR training do not depend on characteristics, such as gender or age, but on the type and location of the bank's office or on office level. Moreover, those who attend the training about insurance sales sold more insurance contracts. Our research will have important implications for academics and for Learning & Development CEOs, because it has demonstrated the effectiveness of VR training on results and its universality for every kind of employee..

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1. Introduction

In recent years, companies have experienced variations in the way they design, deliver and implement training programmes. On average, organizations spend 10% of their budget on learning tools and technologies, with the most popular ones being e-learning platforms, learning management systems and simulations (Radhakrishnan et al., 2021). These investments in training activities allow organizations to adapt, compete, excel, innovate, produce, improve services and achieve business goals.

The latest report by Training Magazine reveals that U.S. training expenditures passed the $100 billion for the first time in 2022. This increase has been due to several factors such as the increase in large companies' budgets, inflation and going back to in-person training, but also to the investment in virtual training technologies. Large companies (with more than 10,000 employees) spent an average of $1689 per learner in 2022, compared to $722 per learner in 2022.

Although this increase in budgets and the fact that some authors pointed out years ago that virtual reality (VR) was one of the most important technologies that will be generally adopted in education in the very near future (Lan, 2020) the truth is that its scope is still reduce, despite its reported advantages.

Research in VR-training systems highlights numerous benefits, including soft-skills acquisitions, increased engagement, presence and immersion and reduced cognitive load (Radhakrishnan et al., 2021).

CONTACT Belén Díaz Díaz diazb@unican.es Dpto. Administración de Empresas, University of Cantabria & SANFI, Avda. de los Castros S/N, 39005 Santander, Spain

The most appealing aspect of using VR for training is the ability to interact with real-world content in a potentially immersive environment (Abich et al. 2021; Lan, 2020).

From a total of 350 peer-reviewed articles about VR-based industrial training, Naranjo et al. (2020) selected 44 and concluded that, among the advantages of using this digital tool in the industry, is the commitment, speed, measurability, preservation of the integrity of workers, customization and cost reduction. Moreover, Papanastasiou et al. (2019) reviewed previous literature about VR effects on education and concluded that this technological tool present numerous advantages of investing time and financial resources such as improving learning outcomes, improving digital-age literacy, creative thinking, communication, collaboration and problem-solving ability. The reduction of costs and the increase in safety and efficiency of employees' performed activities are also some advantages of implementing VR in training as pointed out by Paszkiewicz et al. (2021).

During the period 1998–2008 the scientific production on the use of VR in education to improve the motivation in teaching–learning processes has grown exponentially (Campos Soto et al., 2019). Cózar Gutiérrez et al. (2019) show that both men and women present high levels of motivation in a study run on 94 students. Makransky et al. (2019) obtain the same conclusion about VR motivating properties in the analysis of a sample of 52 university students.

Table 1 summarizes some of the advantages of VR training.

However, the use of VR in training is not without its drawbacks. Menjivar Valencia et al. (2021) reviewed scientific literature from 2016 to 2020 and concluded that while VR is an emerging educational technology, its adoption is still hindered by high costs and technical complexity for trainers.

Similarly, Jensen and Konradsen (2018) found that although VR is effective for skill acquisition, its advantages diminish outside these contexts. They concluded that VR does not offer significant benefits over less immersive technologies or traditional teaching methods. In some cases, it even proved counterproductive due to issues such as cybersickness, technical difficulties or the immersive experience diverting attention from the learning task. Makransky et al. (2019) also highlight certain drawbacks of using VR in training, including cognitive overload and learner distraction, which can ultimately reduce the opportunity to achieve effective learning outcomes.

Considering advantages and disadvantages, the desire to implement immersive technologies in training is growing exponentially. The evaluation of the training effectiveness using VR is especially pertinent given the rising popularity of this technology for training and education across industries.

Jensen and Konradsen (2018) reviewed the use of VR head-mounted displays (HMDs) in education and training. The review of 21 documents reporting on experimental studies identified a number of situations where HMDs are useful for skills acquisitions. These include cognitive skills related to remembering and understanding spatial and visual information and knowledge; psychomotor skills related to head-movement, such as visual scanning or observational skills; and affective skills related to controlling your emotional response to stressful or difficult situations.

In the same way, Abich et al. (2021) conducted a review of the research on the training effectiveness with VR technology to assess the benefits these new technology may bring to the trainee using 21 articles from 1992 to 2019. Most of these publications focused on medical and surgical domains, but other training domains included safety, education and industrial. The evidence supports improved

Table 1. Summary of the advantages of VR in training.

Advantage	Reference
Better cognitive outcomes and attitudes toward learning	Makransky et al. (2019), Clark et al. (2016), Lampropoulos and Kinshuk (2024)
Motivational value	Makransky et al. (2019), Cózar Gutiérrez et al. (2019), Lampropoulos and Kinshuk (2024)
Positive pedagogical value	Scorgie et al. (2024)
Positive effect on learning	Scorgie et al. (2024)
Higher retention in the long term	Scorgie et al. (2024)
Cost reduction	Naranjo et al. (2020), Paszkiewicz et al. (2021)
Interact with real world	Abich et al. (2021), Lampropoulos and Kinshuk (2024)
Increase engagement	Radhakrishnan et al. (2021), Naranjo et al. (2020), Lampropoulos and Kinshuk (2024), Ghazali et al. (2024)
Reduce cognitive load	Radhakrishnan et al. (2021)

psychomotor performance, knowledge acquisition and spatial ability when individuals or teams are trained using VR.

Therefore, VR training not only improves knowledge and skills acquisitions, but also may have an important effect on sales, as it allows an immersive experience by simulating real-life situations that sellers are likely to face on the job. VR complements traditional training in a way that deeply engages the trainees and allow sales professionals to conduct product demonstrations or undertake negotiations with virtual clients even before starting a job in the real world. Sales professionals in several industries like healthcare, pharmaceutical, real state, automobiles and retailing are using VR applications for training purposes.

In sum, VR training covers a wide range of topics, target groups and academic levels. Researchers have explored the applications of 3D virtual worlds in educational contexts within a variety of fields and disciplines such as medicine and health (Menzel et al. 2014), language learning (Hsiao et al. 2017) and engineering (Ghazali et al. 2024). Specifically, VR systems are being utilized mainly for industrial training. The necessity for such implementation responds to the industrial demand for systems that are cost effective, safe, scalable, modular, mobile and capable of enhancing training efficiency (Radhakrishnan et al., 2021).

However, while previous literature established a solid ground for VR-based training in different industries, they do not provide a focus on the financial sector, and particularly on banks, where the benefits of this immersive training could be relevant. VR training offers the capability to banking workers to acquire skills and address complex situations in dealing with a customer by immersing them in a safe and controlled virtual environment. VR offers unique opportunities for practice and decision-making under pressure, without risk for companies or their clients. Moreover, VR training could help banks to face the challenge of having to train employees in different geographies because of the dispersion in the location of bank offices. The availability of HMDs' low budget for mobile devices could lead to face this challenge in a cost-effective way.

VR technology has shown its effectiveness in the financial sector in contexts other than training, such as the improvement of customer experience (Mbaye, 2024), the democratization of financial education (Oyewole et al., 2024) or the improved feelings of presence and closeness when conducting meeting using VR (Campbell et al., 2020).

Therefore, the use of VR in training in the banking sector is an unexplored issue that need to be addressed to help Learning & Development CEOs take decisions about the most effective teaching methodology for their employees and allocate a budget accordingly to their objectives.

In taking this decision about the usage of VR in training, Learning & Development CEOs will also benefit from knowing what kind of trainee is more effective when using this technology and who values more this VR training. As resources are scarce, CEOs will have to allocate budget where they believe the training will be best received. Previous research has shown that training with VR may be more effective for those that have less familiarity with the training content. However, this is not to suggest that VR is ineffective for experienced trainee (Abich et al., 2021).

Gender can also affect learning performance. Women's persistence and commitment, along with their stronger self-regulation (Alghamdi et al., 2020), could lead to better learning outcomes than men. However, while some studies relating gender to training success found better results for women, others found better results for men (Ackerman et al., 2001).

Also, previous literature presents varied findings regarding the association between age and training outcomes, being the relationship between age and success positive in Beier and Ackerman (2005) and negative in Korlat et al. (2021), among others.

Regarding satisfaction with VR training, the experience reported by the user of HMD-mediated VR, is not always positive. A number of users report experiencing adverse symptoms, including nausea and disorientation or headaches, among others (Dużmańska et al., 2018). These symptoms are commonly known as simulator sickness (SS) that some authors have found to have higher incidence in women than in men (Munafo et al., 2017).

In sum, the aim of this research is to analyse the impact of VR training on business results in the banking sector and, in particular, on insurance sales, which has been unexplored in previous literature. Moreover, although some characteristics of the trainee have been reported to influence the success in

the training and the satisfaction with it (such as seniority, gender or age), no consensus has been found and other characteristics related to trainee's job could also influence the training experience. With the aim to cover these gaps, we add to previous literature by investigating the use of VR in an immersive training experience in the banking sector, using a specific VR experience 30 min long about insurance sales in Santander Bank. To the best of our knowledge, this is the first paper dealing with the effectiveness of VR training to improve banking results.

Our objective is to address the following research questions and hypotheses.

RQ1. Which type of trainee achieves better results in VR-based training?

H1. 1. Gender affect the outcomes achieved in training.

H1. 2. Age affect the outcomes achieved in training.

H1. 3. Seniority affect the outcomes achieved in training.

We will also explore other variables such as location or type of bank office.

RQ2. Which type of trainee values VR-based training most?

H2. 1. Gender affect the satisfaction with the training.

H2. 2. Age affect the satisfaction with the training.

H2. 3. Seniority affect the satisfaction with the training.

We will also explore other variables such as location or type of bank office.

RQ3. Are trainees that have attended the VR-based training about insurance sales more successful in selling insurance compared to employees who have not used VR?

H3. 1. Employees who attended the VR training sell more insurance contracts.

H3. 2. Employees who attended the VR training sell insurance contracts with a greater value.

The results of our research will have important implications for academics as well as for Learning & Development CEOs in the financial industry since it will analyse empirically the use and effectiveness of this disruptive methodology in training and it will help to show if the advantages attributed to VR in the literature are demonstrated.

2. Methodology

Previous research analysing the use of VR in training usually follow a structured methodology based on the steps of Figure 1 (based on Ghazali et al. 2024; Menzel et al. 2014; Radhakrishnan et al., 2021, among others).

In line with this approach, this research follows different phases to achieve the final objective of analysing the results of the experience with VR training.

First stage: study and training design. During the design of the insurance sales training using VR, several recommendations given by Abich et al. (2021) for achieving training outcomes, were considered:

- VR was used as an active interaction training platform and not as a passive/viewing only.
- Gesture-based interactions reflected real world or on the job actions. The VR training replicates exactly a Santander bank office.
- Prior designing the VR-training experience we had two meetings with the directors of ten Santander smart offices and did three in person shadowing in the offices to account for individual needs and understand the training audience.
- A clear identification of the type of knowledge to be trained was done, considering the assessment of the insurance area and of the responsible of smart offices in Santander Bank.

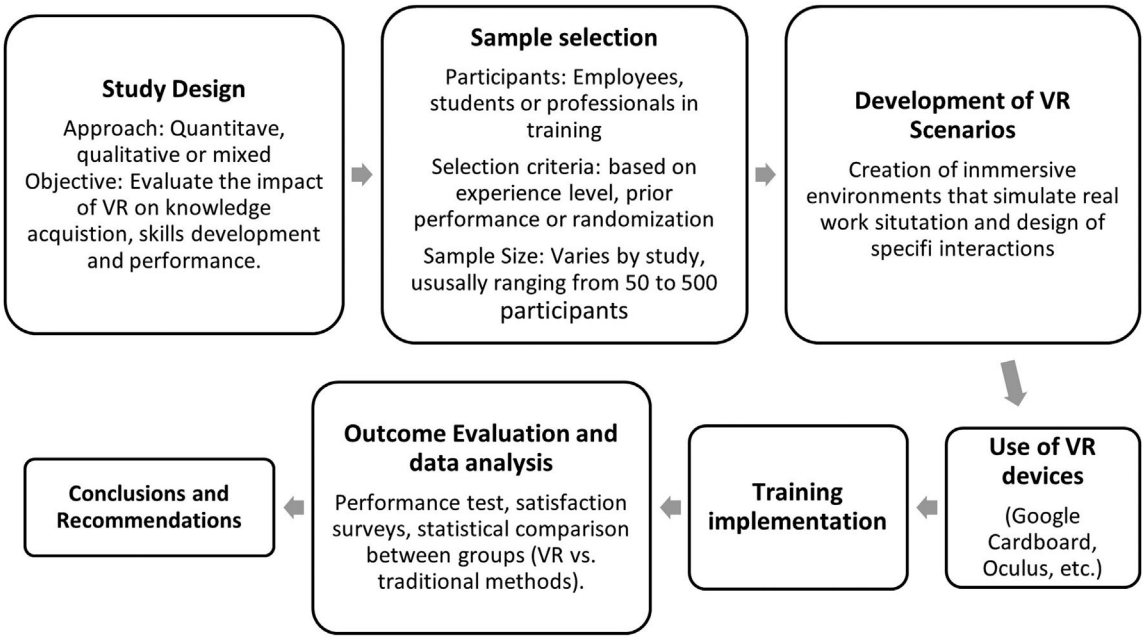

Figure 1. Methodology steps in VR-based training.

Second stage: sample selection. Within the entire universe of Santander bank employees who, among other functions, are assigned to selling insurance contracts (8,820 people), 249 underwent training using VR between November 2022 and March 2023.

These 249 individuals were selected based on their low performance in insurance sales, considering that they could benefit the most from this training. This sample was almost equally distributed between men (122 which represent 49% of the sample) and women (127 which represent 51% of the sample).

Thus, the sample consisted of a group of 249 people who used VR and 8,571 who did not.

Third stage: selection of the HMDs for mobile devices (Google Cardboard). Google Cardboard was chosen as the VR hardware due to its affordability (it is a low-cost VR solution), ease of use (requires only a smartphone and the Cardboard viewer), portability (lightweight and easy to transport), scalability (can be distributed to a large number or trainees), compatibility (woks with most smartphones) and quick implementation (no need for complex installations).

Fourth stage: development of VR scenarios and training implementation in each region, considering small groups of trainees who did the training at the same time.

Specific training scripts were developed considering four different kind of customers who could walk into the bank office. The trainee had to face different situations and decide the best way to behave.

The VR training included four situations with individuals or a legal entity with the aim to increase or maintain insurance sales:

Situation 1 with an individual—Conducting a meeting with a private client interested in a home insurance—8 min.
Situation 2 with a legal entity—Carrying out a commercial visit to a new store—6 min.
Situation 3 with an individual—Reversing a potential cancellation—6 min.
Situation 4 with an individual—Scheduling an appointment for comprehensive insurance management—10 min.

Finally, a 30 min VR training about insurance sales was developed.

Before expanding the training to a larger sample, a user test was conducted with a sample of 10 employees to verify that everything was working correctly and that the situations and challenges the users had to face were understandable.

Fifth stage: analysis of training Key Performance Indicators (KPIs). We considered two indicators:

- Success. The percentage of questions about the training correctly answered during and at the end of the training through the HMDs. With this indicator, we will analyse if there are differences in the results obtained in VR-based training when we distinguish different characteristics of the trainees (such as gender, age and seniority).
- Satisfaction. The valuation given to the VR training ranging from 1 to 5 (being 5 the best valuation). With this indicator, we will analyse which kind of trainee values best VR-based training. For example, are older employees or with greater seniority more reluctant to this methodology of training because of its technological complexity?

To test if there are differences among groups, we run a nonparametric test. In particular, a Kruskal–Wallis test, in order to test whether samples are originated from the same distribution. It extends the Mann–Whitney *U* test to more than two groups. The null hypothesis of the Kruskal–Wallis test is that the mean ranks of the groups are the same.

Sixth stage: analysis of business KPIs to conclude about the success of VR training in the selling of insurance. Two indicators were considered: the number of insurance contracts sold (NIS) in the trimester that follows the end of the training and the value of such insurance contracts sold.

We also run a Kruskal–Wallis test to determine if there is a statistically significant difference in selling insurances between the group that did the VR training and the group that did not.

Seventh stage: regression analysis. Firstly, we examine the influence of different independent variables on training KPIs. We test if the success in the VR training and the valuation given to the training depend on:

- characteristics of the employee (such as gender, seniority or job classification),
- characteristics of the office the employee belongs to (office level or type of office),
- the location of the office.

This analysis is done for a sample of 249 employee who did VR training.

$$\text{Success} = \text{Constant} + \beta_1\text{Gender} + \beta_2\text{lnSeniority} + \sum \beta_i\text{Dummy Job classification}_i + \sum \beta_j\text{Dummy Office level}_j + \sum \beta_k\text{Type of office}_k + \sum \beta_l\text{Dummy Location}_l$$

$$\text{Satisfaction} = \text{Constant} + \beta_1\text{Gender} + \beta_2\text{lnSeniority} + \sum \beta_i\text{Dummy Job classification}_i + \sum \beta_j\text{Dummy Office level}_j + \sum \beta_k\text{Type of office}_k + \sum \beta_l\text{Dummy Location}_l$$

Secondly, we examine the influence of different independent variables on business KPIs. We test if the NIS or the value of such contracts depend on:

- the fact of having done the VR training,
- characteristics of the employee (such as gender, seniority or job classification),
- characteristics of the office the employee belongs to (office level or type of office) or the location of the office.

This analysis is done for a sample of 249 employees who did VR training joined to 8571 employees who did not.

$$\text{Number of insurances sold (NIS)} = \text{Constant} + \beta_1\text{RV} + \beta_2\text{Gender} + \beta_3\text{lnSeniority} + \sum \beta_i\text{Dummy Job classification}_i + \sum \beta_j\text{Dummy Office level}_j + \sum \beta_k\text{Type of office}_k + \sum \beta_l\text{Dummy Location}_l$$

$$\text{Value of insurances sold (VIS)} = \text{Constant} + \beta_1 \text{RV} + \beta_2 \text{Gender} + \beta_3 \text{lnSeniority} + \sum \beta_i \text{Dummy Job classification}_i + \sum \beta_j \text{Dummy Office level}_j + \sum \beta_k \text{Type of office}_k + \sum \beta_l \text{Dummy Location}_l + \varepsilon$$

Table 2 shows the definition of the variables used for the analysis of training and business KPIs and for the regression analysis.

3. Findings and discussion

3.1. Findings about the success in VR training

To answer the question about what kind of trainee has better results in VR-based training (success), we considered the percentage of questions about the training correctly answered during and at the end of the training through the HMDs by different groups of trainees.

The mean value of success is 0.7658, which means that employees who did the VR training answered correctly to 76.58% of the questions included in the training. According to the results shown in Table 3, Gender shows not statically significant to explain the success in the training and no difference is found in the percentage of questions correctly answer when we distinguish between women and men. The same absence of significance is observed when we consider seniority and age. Therefore, being older or younger or having more experience in the job does not affect the success in the VR training.

In fact, none of the variables considered in the analysis of success in VR were significant. Since the success in VR in training does not depend on personal characteristics of the trainee (such as gender, age, seniority, job classification, employee level), nor on office characteristics (such as office level or type of office) or location, we can eliminate stereotypes such as thinking that VR is only oriented to young people. VR training in the financial sector can be used by every kind of trainee/employee because all succeed the same.

Following the analysis of differences in mean values of success in VR training, we accomplished a regression analysis,[1] where the dependent variable was Success and the independent variables were Gender, Seniority, Job classification, Type of Office and Location. The JOINT *F*-test shows that the regression model was significant (Table 4). The results show a significant influence of Seniority in VR-training success, indicating lower success when seniority is higher. This result confirms Abich et al. (2021) finding that VR is more effective for those that have less familiarity with the training content, supporting Hypothesis 1.3. However, other employees' characteristics, such as gender and age, show not significant, contrary to Hypotheses 1.1 and 1.2 but supporting the lack of consensus about how these variables influence the success in VR training (Alghamdi et al., 2020; Beier & Ackerman, 2005; Korlat et al., 2021).

To improve the visualization of the results, graphs have been added only for statistically significant variables that affect success in VR training. Figure 2 shows the relationship between success in VR training and seniority, having higher seniority a negative influence in success.

Type of office (Figure 3) and location (Figure 4) show significant in explaining the success of employees in the VR training. We observed higher values for smart offices and workcafe offices, both characterized for having more employees and extended opening hours. However, we observed lower value in Extremadura, the second region with the lower GDP per capita in Spain, which may hinder the work of bank employees and their performance in training.

3.2. Findings about the satisfaction with the VR training

We also explored the experience of the trainee with the VR training and whether different groups of trainees show different satisfaction with VR-based training. Following the same methodology as in the previous section, we considered the satisfaction with VR training ranging from 1 to 5 and dividing the sample into different groups according to the trainee characteristics, the office characteristics or location.

Table 2. Definition of variables for the analysis of KPIs and the regression analysis.

	Definition
Dependent variables	
Success	Percentage of questions about the VR training correctly answered during and at the end of the training through the HMDs.[a] It takes values between 0 and 1
Satisfaction	Satisfaction with the VR training ranging from 1 to 5 (being 5 the best valuation)[b]
NIS	Number of insurance contracts sold by each employee in the trimester that follows the end of the training.
Value of insurance contracts sold (VIS)	Value of insurance contracts sold by each employee in the trimester that follows the end of the training.
Independent variables	
RV	Dummy variable that takes value 1 if the employee has done the VR training and 0 otherwise
Gender	Dummy variable that takes value 1 if women and 0 if men
Seniority	Years of seniority in the job. We have considered four groups for the Kruskal–Wallis test: • Less than 10 years • Between 11 and 20 years • Between 21 and 30 • Higher than 30 We have considered the natural logarithm of seniority for the regression analysis.
Age group	Age of the employee. We have considered four groups for the Kruskal–Wallis test: • Less than 35 years • Between 36 and 45 years • Between 46 and 55 • Higher than 55 We have considered the natural logarithm of age for the regression analysis.
Job classification	Employees belong to one of the following classifications: • Commercial &Business Banker • Customer S&S: F2F • Customer S&S: specialized products
Employee level	We distinguished 10 categories according to the level the employee has been recognized. From level 6 to level 15. A higher level indicates a higher category.
Office level	We distinguished 6 categories according to the level the office has been recognized. From level 10 to level 15. A higher level indicates a higher category.[c]
Type of office	We distinguished five categories according to the following classification: • Business-oriented office • Smart business-oriented office • Universal office • Smart universal office • Workcafe office
Location	We distinguished 10 locations according to the region the office the employee belongs to is located across the Spanish geography: • Aragón, Asturias, Canarias, Cantabria, Castilla la Mancha, Castilla León, Extremadura, Galicia, Islas Baleares and País Vasco.

[a]During the training, the trainee had to answer 23 questions. Each question presented a different situation between a customer and a bank employee, requiring the employee to decide on the best course of action in the context of insurance sales. At the end of the training, the trainee had to answer five additional questions to assess their retention and practical understanding. All these questions were answered using the HDMs.
[b]The trainee was asked to evaluate their satisfaction with the VR training by answering a single question.
[c]Bank branches are categorized into different levels based on various criteria, such as business volume, number of clients, revenue generated, location, and level of operational complexity. A higher level indicates that the branch handles a larger volume of financial operations, transactions, and banking products, has a higher number of clients with a more advanced product portfolio, generates higher revenues, and is located in urban areas or regions with high economic activity.

Employees valued VR training in a very positive way giving a mean value of 4.5. When we divide the employees in different groups according to personal characteristics (gender, seniority, age group and job classification), we find no differences in the evaluation given to VR training (Table 5). Therefore, we found no support for Hypotheses 2.1, 2.2 and 2.3.

However, when we divide employees according to office characteristics and location we find significant statistical differences.

Employees who belong to a higher-level office value VR training worse than employees in a lower-level office do. In particular, a valuation between 5 and 4.86 is found in low-level offices as compared with a value between 4.57 and 4.35 found in high-level offices. This result could be explained because of the higher workload high-level offices have and therefore, its employees are less receptive to receiving training.

Table 3. Success in VR training according to trainee's personal characteristics, office characteristics and location.

		No. obs.	Mean	Std. dev.	Kruskal–Wallis chi2 (prob.)
Gender	Women	120	0.7643	0.0821	1.643
	Men	114	0.7675	0.1200	(0.1999)
Seniority	Less than 10 years	7	0.7566	0.1189	4.812
	Between 11 and 20	143	0.7744	0.1046	(0.1860)
	Between 21 and 30	64	0.7579	0.958	
	Higher than 30	20	0.7329	0.0958	
Age group	Less than 35 years	4	0.7645	0.1211	2.329
	Between 36 and 45	118	0.7767	0.0917	(0.5070)
	Between 46 and 55	98	0.7520	0.1156	
	Higher than 55	14	0.7720	0.0750	
Job classification	Commercial & Business Banker	40	0.7542	0.1009	0.818
	Customer S&S: F2F	117	0.7664	0.1023	(0.6643)
	Customer S&S: specialized products	17	0.7873	0.1054	
Employee level	Level 6	1	0.7500	0.0000	14.429
	Level 7	17	0.7708	0.1676	(0.1079)
	Level 8	73	0.7727	0.0963	
	Level 9	27	0.7434	0.1004	
	Level 10	46	0.7389	0.0830	
	Level 11	29	0.7782	0.1137	
	Level 12	22	0.7998	0.0647	
	Level 13	11	0.8000	0.0926	
	Level 14	6	0.7294	0.1326	
	Level 15	2	0.7747	0.1165	
Office level	10	6	7	0.7387	6.331
	11	15	20	0.7392	(0.2753)
	12	32	44	0.7549	
	13	29	50	0.7573	
	14	42	60	0.7900	
	15	34	53	0.7692	
Type of office	Business-oriented office	2	0.7148	0.1204	3.0717
	Smart Business-oriented office	5	0.8103	0.0827	(0.5550)
	Universal office	106	0.7586	0.1031	
	Smart Universal office	112	0.7709	0.1024	
	Workcafe office	9	0.7749	0.1009	
Location	Aragón	15	0.7681	0.0848	8.439
	Asturias	11	0.7772	0.0665	(0.4906)
	Canarias	28	0.7589	0.0786	
	Cantabria	13	0.7927	0.0813	
	Castilla la Mancha	25	0.7682	0.0769	
	Castilla León	33	0.7603	0.1517	
	Extremadura	38	0.7342	0.1065	
	Galicia	46	0.7858	0.0847	
	Islas Baleares	18	0.7716	0.1370	
	País Vasco	7	0.7646	0.0684	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

Table 4. Regression analysis on success in VR training.

	Success		
	β	t	Sig.
Constant	0.9477	12.17	0.000***
Gender	−0.0144	−1.07	0.284
LnSeniority	−0.0554	−2.33	**0.021****
Dummy Job classification	Yes		No sig.
Dummy Type of Office	Yes		Sig.
Dummy Location	Yes		Sig.
Number of observations		233	
F		1.63	
Prob. > F		0.0577*	
R-squared		0.0779	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. The bold values are statistically significant.

In addition, the type of office shows significant to differentiate the valuation given to VR training. In universal offices (general or smart) a lower valuation is found (between 4.26 and 4.68) as compared with business-oriented offices or workcafe, showing a lower satisfaction in universal offices that offers a full range of financial services, including retail, corporate and investment banking and characterized by less

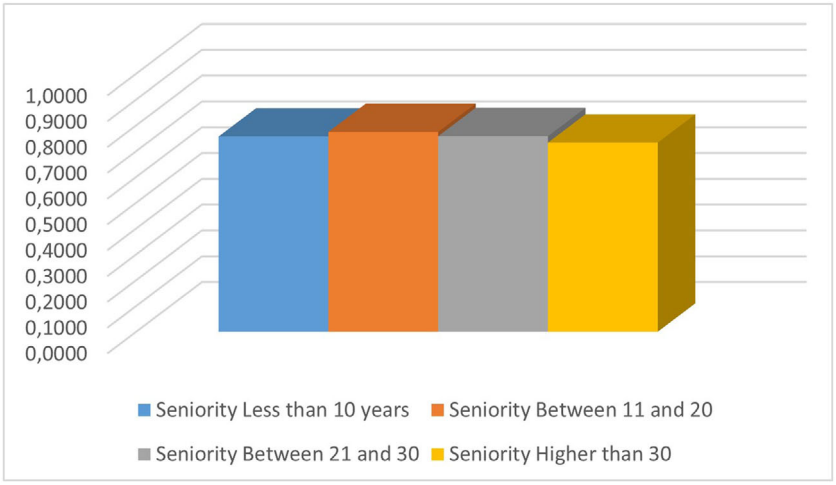

Figure 2. Relationship between success in VR training and seniority. *Note:* Higher seniority influences negatively the success in the VR training.

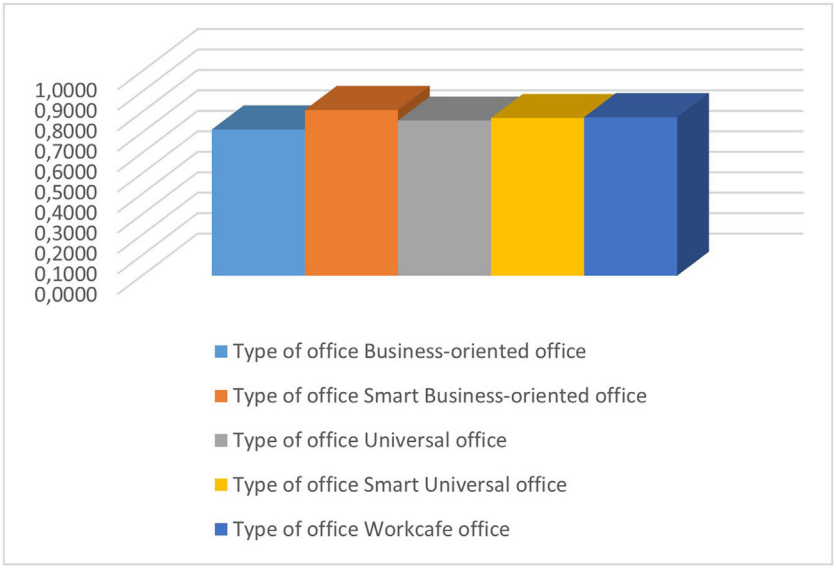

Figure 3. Relationship between success in VR training and type of office. *Note:* There are significant differences in the success in VR training among types of offices, having higher values for smart offices and workcafe office.

specialization and high workload. Again, the workload could explain the worse rating given in more generalist offices with a more diverse clientele.

Location is also statistically significant to explain differences in VR-training valuation. Employees from Aragón and Cantabria value the training between 4.8 and 4.9 while employees in Castilla y Leon and Pais Vasco value the training between 3.2 and 3.5. Employees in each region were summoned at the same time to experience the VR experience. How the project was communicated in each region, the place where employees were summoned, the first experience with the HMDs or the support of the regional director could explain the differences in the valuation of VR training.

Following the analysis of differences in mean values of the evaluation given to VR training, we accomplished a regression analysis, where the dependent variable was Satisfaction and the independent variables were Gender, Seniority, Job classification, Type of Office and Location. The JOINT F-test shows that the regression model was significant (Table 6). Type of Office and Location are significant, as also shown in the Kruskal–Wallis analysis.

To improve the visualization of the results, graphs have been added only for statistically significant variables that affect the satisfaction with the VR training. The relationship between satisfaction with VR training and office level in Figure 5, with type of office in Figure 6 and with location in Figure 7.

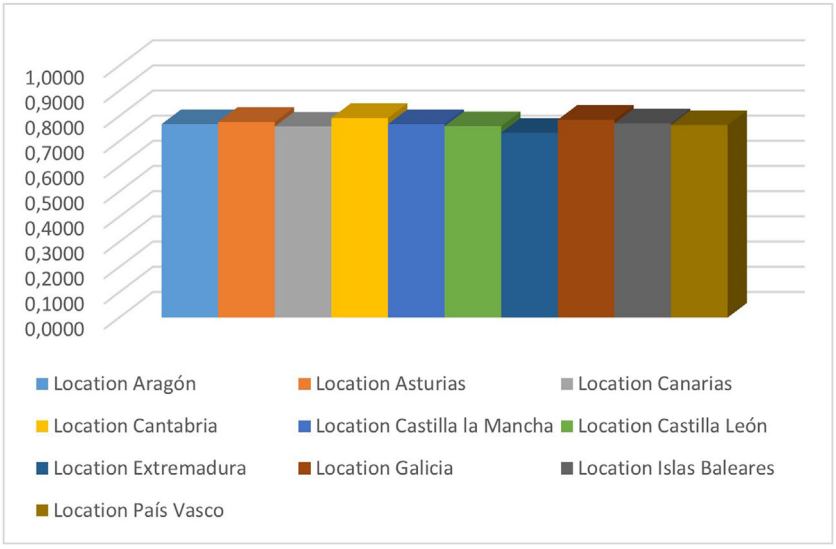

Figure 4. Relationship between success in VR training and location. *Note:* There are significant differences in the success in VR training among regions in Spain.

3.3. Findings about the impact of VR training on business KPIs

The Kruskal–Wallis analysis (Table 7) show that those employees who have done the VR training sold more insurance contracts in the trimester that follows the training (5.7 contracts) than the employees, that did not do this training (4.8 contracts). Moreover, we observe a greater VIS by employees who did the VR training (2779.5€) in comparison with those that did not the training (2433.5€). Therefore, our results support the hypothesis about the higher effectiveness of VR training (Hypotheses 3.1 and 3.2), showing higher sales (in number and in value) of insurances by those who did the VR training.

Figure 8 shows the NIS and Figure 9 shows the value of these insurance contracts depending on having done or not the VR training.

Table 8 shows the results of the regression analysis, where the dependent variable was Number of insurance contracts and the independent variables were RV, Gender, Seniority, Job classification, Type of Office and Location. The JOINT F-test shows that the regression model was significant. Having done the VR training is significant in explaining the number of contracts sold. In addition, all the other variables introduced in the model as control variables were significant, showing that women and less seniority employees sold more insurance contracts. However, when we consider having done the VR training to explain the VIS, the results are not significant. Control variables are also significant in this case.

Therefore, our results aligns with previous research findings in different domains supporting he idea that VR training outperforms traditional methods in terms of knowledge acquisitions and knowledge retention (Scorgie et al., 2024) or that it boosts the trainees' understanding and problem-solving skills (Ghazali et al., 2024). Our study goes even further than these conclusions by demonstrating a positive impact on insurance sales among those who completed the VR training, supporting our Hypotheses 3.1 and 3.2 in the Kruskal–Wallis analysis and Hypothesis 3.1 in the regression analysis.

In sum, the answer to our research questions would be the following:

- According to our first research question about what type of trainee has better results in VR-based training, we found that seniority has a significant impact on success in VR training in a negative way. Moreover, we found some evidence of significant impact when considering type of office and location. However, this does not mean that employees characterized by specific personal, office or location characteristics do not have success in VR training.
- According to our second research question about what type of trainee is more satisfied with VR-based training, we have found that office level, type of office and location can have a significant

Table 5. Satisfaction with VR training according to trainee's personal characteristics, office characteristics and location.

		No. obs.	Mean	Std. dev.	Kruskal–Wallis chi2 (prob.)
Gender	Women	82	4.4756	0.9966	0.578
	Men	76	4.5789	0.9697	(0.4469)
Seniority	Less than 10 years	6	5.0000	0.0000	4.300
	Between 11 and 20	94	4.5319	0.9355	(0.2309)
	Between 21 and 30	43	4.3488	1.2127	
	Higher than 30	15	4.8000	0.5606	
Age group	Less than 35 years	3	3.6666	2.3094	2.716
	Between 36 and 45	80	4.7000	0.6243	(0.4375)
	Between 46 and 55	64	4.328	1.2479	
	Higher than 55	11	4.6363	0.6741	
Job classification	Commercial & Business Banker	29	4.6896	0.7608	3.146
	Customer S&S: F2F	117	4.5299	0.9876	(0.2074)
	Customer S&S: specialized products	12	4.0833	1.3113	
Employee level	Level 6	1	5.0000	0.0000	6.320
	Level 7	8	4.2500	1.4880	(0.7075)
	Level 8	51	4.5098	1.0463	
	Level 9	18	4.8333	0.5144	
	Level 10	32	4.4687	0.9152	
	Level 11	22	4.3181	1.1291	
	Level 12	14	4.7857	0.5789	
	Level 13	6	4.6666	0.5163	
	Level 14	4	4.0000	2.0000	
	Level 15	2	5.0000	0.0000	
Office level	10	6	5.0000	0.0000	**10.748**
	11	15	**4.8666**	0.3518	**(0.0566)***
	12	32	4.1875	1.2556	
	13	29	4.7586	0.5109	
	14	42	4.5714	1.0852	
	15	34	**4.3529**	1.0410	
Type of office	Business-oriented office	2	5.0000	0.0000	**9.301**
	Smart Business-oriented office	5	5.0000	0.0000	**(0.0540)***
	Universal office	74	**4.6891**	0.7007	
	Smart Universal office	71	**4.2676**	1.2300	
	Workcafe office	6	5.0000	0.0000	
Location	Aragón	10	**4.9000**	0.3162	**39.991**
	Asturias	8	4.7500	0.4629	**(0.0001)*****
	Canarias	17	4.7647	0.5622	
	Cantabria	9	**4.8888**	0.3333	
	Castilla la Mancha	15	**5.0000**	0.0000	
	Castilla León	21	**3.2857**	1.7071	
	Extremadura	25	4.7200	0.6137	
	Galicia	35	4.6571	0.8023	
	Islas Baleares	12	4.7500	0.4522	
	País Vasco	6	**3.5000**	0.8366	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

Table 6. Regression analysis on satisfaction with VR training.

	Satisfaction		
	β	t	Sig.
Constant	5.5105	7.07	0.000***
Gender	−0.2125	−1.43	0.154
LnSeniority	−0.2381	−0.99	0.322
Dummy Job classification	Yes		No sig.
Dummy Type of Office	Yes		Sig.
Dummy Location	Yes		Sig.
Number of observations		157	
F		3.76	
Prob. > F		0.0000***	
R-squared		0.3496	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

effect on satisfaction, but employee personal characteristics do not condition the satisfaction with the training.

- Finally, we can conclude that trainees that have attended the VR-based training about insurance sales are more successful in selling insurances than those employees that have not used VR, showing a higher NIS.

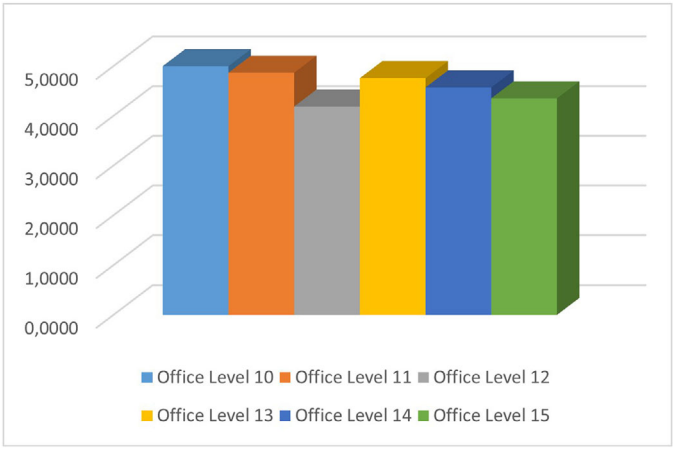

Figure 5. Relationship between satisfaction with VR training and office level. *Note:* Negative relationship between satisfaction and office level.

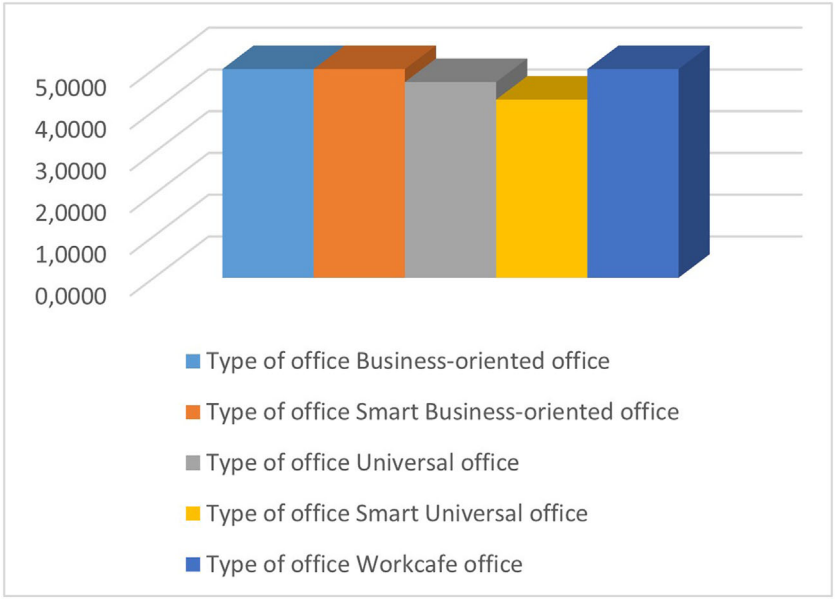

Figure 6. Relationship between satisfaction with VR training and type of office. *Note:* Lower satisfaction in universal offices than in business-oriented offices or workcafe office.

4. Conclusions

VR extends online training and enhances the results by adapting real consequences wherein trainees interact and experiment with objects and in an environment with similitude to real life.

A trainee can gain virtual experience and be better prepared for sales experiences that may occur in future. The trainee is able to participate in life-like engagement, which increases the retention of content. Other benefits of VR-based training include cost control, convenience, modular design, scalability and diversity.

Some previous literature have found that training with VR was either less effective or equivalent to other approaches across many disciplines and tasks (Abich et al., 2021). Moreover, the barriers to VR adoption includes awareness, followed by content and cost. Many organizations and training managers are still unaware of effective VR-training solutions. Penetration and adoption are still not widespread owing to prohibited costs (Upadhyay & Khandelwal, 2018).

However, even though several research gaps have been found, VR is a present and future alternative for the efficient training of human resources. Our research has demonstrated that VR training in the banking sector has a positive impact on insurance sales. The findings also show that every kind of employee can have success in this training and values favourably VR. This suggests broader implications

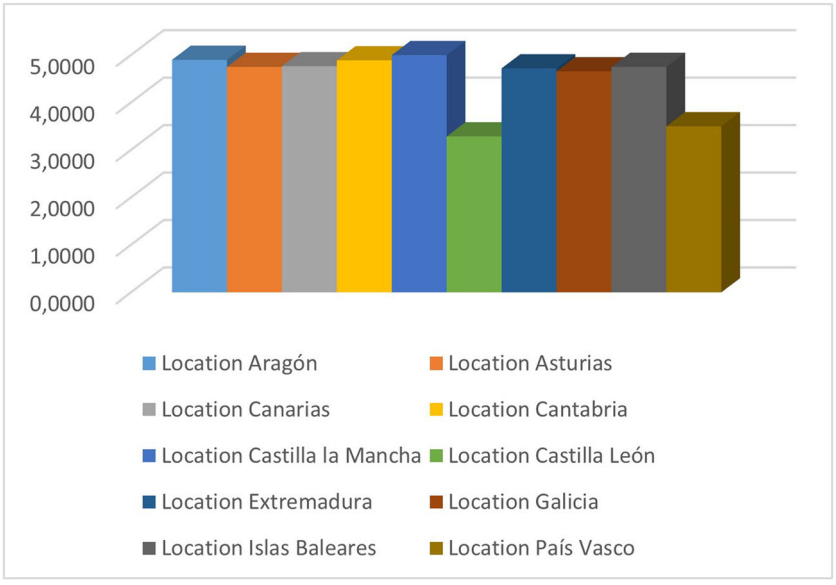

Figure 7. Relationship between satisfaction with VR training and location. *Note:* There are significant differences in the satisfaction with VR training among regions in Spain.

Table 7. Number and value of insurance contracts per employee according to having done or not the VR training.

		No. obs.	Mean	Std. dev.	Kruskal–Wallis chi2 (prob.)
Number of insurance contracts per employee					
VR training	Yes	224	5.7767	4.7108	13.880
	No	8571	4.8120	4.6718	(0.0002)***
Value of insurance contracts per employee					
VR training	Yes	224	2779.5	3159.3	6.950
	No	8571	2433.5	4131.7	(0.0084)***

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

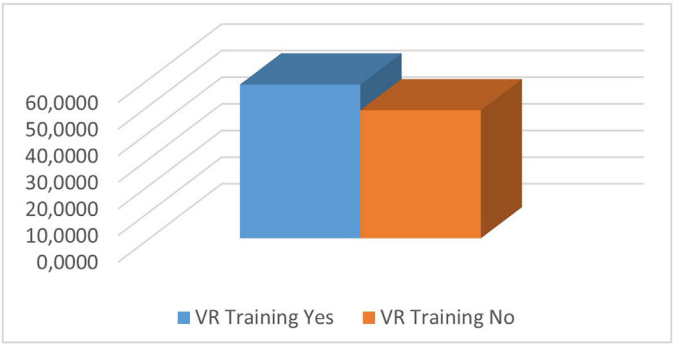

Figure 8. NIS depending on having done or not the VR training. *Note:* Employees who did the VR training sold more insurance contracts than employees who did not attend the VR training.

for policy and investment in training technologies beyond the financial sector. Since success in VR training and satisfaction is not dependent on personal characteristics, industries such as education, healthcare and manufacturing could also leverage its benefits to improve workforce development. Investing in immersive training tools could lead to better learning retention and skill acquisition across different fields. Therefore, policies that support accessibility and innovation in VR training should be considered to maximize its impact across various industries.

The results of our research could be of interest for academics, as it extends previous literature by analysing whether the effectiveness of VR is contingent on several characteristics of the trainee, as well as whether VR lead to better business results. In this sense, this study sheds light on how the advantages pointed out by the theoretical literature about VR are consistent with the empirical evidence found.

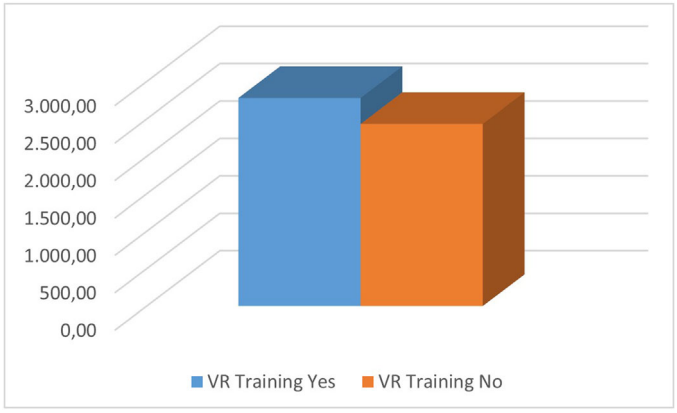

Figure 9. VIS depending on having done or not the VR training. *Note:* Employees who did the VR training sold insurance contracts with a greater value than employees who did not attend the VR training.

Table 8. Regression analysis on number and value of insurance contracts.

	Number of insurance contracts			Value of insurance contracts		
	β	t	Sig.	β	t	Sig.
Constant	7.0527	11.42	0.000***	7.8783	57.87	0.000***
RV	0.7989	2.70	**0.007***	0.1016	1.49	0.136
Gender	0.7165	7.52	**0.000***	0.1954	7.52	**0.000***
LnSeniority	−0.4907	−3.75	**0.000***	−0.1249	−3.56	**0.000***
Dummy Job classification	Yes		Sig.	Yes		Sig.
Dummy Type of Office	Yes		Sig.	Yes		Sig.
Dummy Location	Yes		Sig.	Yes		Sig.
Number of observations		8528			6877	
F		212.10			14.51	
Prob. $> F$		0.0000***			0.0000***	
R-squared		0.1692			0.0558	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

These results could also help Learning & Development CEOs in the financial industry in the design of human resource training policies and in the choice of workers to whom VR training should be applied.

Despite the fact that there are various barriers and challenges in spreading the adoption of VR on training practices, VR technology provide an effective tool to enhance learning and memory, as it provides immersed multimodal environments enriched by multiple sensory features (Papanastasiou et al., 2019).

The findings of this study contribute to the body of knowledge by providing evidence of learning affordance of VR in bridging experience-related gaps and suggesting opportunities for accelerating workplace expertise development among trainees via technology intervention.

Future research would need more theoretical grounding because very few studies on the usage of VR in training explicitly adopted theories, as also suggested by Scorgie et al. (2024). Also, an in depth research is required to understand the reasons for different results in training success and satisfaction when employees are in different locations or type of bank office. Moreover, more empirical research is fundamental to prove if the results obtained for the financial sector can be really extrapolated to other sectors of activity. As far as we are concern, no study has empirically analysed the impact of VR training in business results (such as the increase in sales) and our research is pioneering in demonstrating this relationship and highlighting the need for further research. Finally, Scorgie et al. (2024) already highlighted a critical need for long-term retention measurements, as only 36% of the 52 studies they analysed about VR for safety training in various industries (such as construction, fire, aviation and mining) provided such data. In this sense, our research showed higher insurance sales during the trimester that follows the VR training, but to assess long-term retention, further research on the persistence of this trend over time would be necessary.

Note

1. The Breusch–Pagan/Cook Weisberg test for heteroskedasticity showed the absence of homoskedasticity and therefore the presence of heteroskedasticity (the variance of the residuals is unequal over a range of measured values). In the presence of heteroskedasticity, we run robust linear regression, which is less sensitive to outliers than standard linear regression.

Author contributions

BDD and RGR contributed to experimental design, analysis, validation and investigation. BDD, RGR and SAM contributed to review, visualization, writing and editing. All authors have read and agreed to the published version of the manuscript.

Ethics statement

The data used is anonymous and cannot be linked to any individual, and therefore no ethical approval was needed.

Disclosure statement

The authors declare no conflict of interest.

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About the authors

Belen Diaz Diaz is Ph.D. in Finance. She is Associate Professor of Finance at the University of Cantabria (Spain) and Academic Director and researcher at Santander Financial Institute (SANFI). Previously, she has been Vice-Dean of the Faculty of Economics and Business Administration and Director of Campus and Social Development at the University of Cantabria. She has been visiting researcher at the University of California in Berkeley, the London School of Economics, the University of Technology in Sydney, and at different universities in Mexico, Chile, Brazil, Argentina and Morocco. Professor Díaz is author of several papers about CSR, Corporate Governance, banking and corporate finance in academic journals and books. The quality of her research was recognized with the "Sanchis Alcover Award", awarded by the Scientific Association of Economy and Management in 2006. Since 1996, she has written several reports and developed more than 50 R&D projects about different financial and economic issues commissioned by different public and private entities.

Rebeca García-Ramos is Associate Professor of Finance in the Universidad de Cantabria (Spain) and Researcher of the Santander Financial Institute (SANFI). She is Graduate in Economics and Doctor of Business Administration by the University of Cantabria (UC), with a qualification of Distinction Cum Laude and International Mention. She has been visiting researcher of the Business School of the University of Essex (United Kingdom) the University of Oviedo (Spain) and the University of the Basque Country (Spain). Her researcher activity focuses on the field of Corporate Finance, Corporate Governance, CSR, Family Firms and Gender Diversity, being author of several chapters in books and national and international prestigious scientific journals in her field. She has developed and coordinated several R+D reports about different economic issues requested by both public and private institutions. She is also referee of scientific journals in her field and has been part of various organizer and scientific committees of international conferences. Her research job has been awarded with several recognitions, as the "Jeff Rothstein Award for the Most Creative Paper", granted by the Family Firm Institute (FFI) and Hubler Family Business Consultants, or the "Research Award of the Section of Family Business" granted by the Spanish Scientific Association of Economy and Business Management, among others.

Sandro Arrufat-Martín, Doctor Cum Laude in Communication Sciences from Rey Juan Carlos University (2021). Master's in Protocol, Communication, and Comprehensive Event Organization from URJC (2018) and Master's in

Corporate Communication Management from EAE Business School (2017). Bachelor's in Journalism from UDIMA (2016). Currently, an associate professor at Rey Juan Carlos University, having won a competitive selection in the Department of Audiovisual Communication and Advertising. He teaches at both undergraduate and master's levels at EAE Business School, UNIR, and the Madrid Chamber of Commerce. Moreover, he is an author in journals indexed in the Arts & Humanities Citation Index (A&HCI) of Web of Science, Scopus, Emerging Sources Citation Index (ESCI), Latindex, among others. He has also published book chapters listed in the Scholarly Publishers Indicators (SPI). In addition, he has been involved in various research projects related to digital communication management and strategies, social networks, and corporate reputation. Similarly, his research areas include public relations, branding, and corporate communication. Professionally, he has served as the Director of Communication and Institutional Relations at Santander Financial Institute (SANFI), sponsored by Banco Santander and the University of Cantabria.

ORCID

Belén Díaz Díaz http://orcid.org/0000-0001-7421-4085

Data availability statement

Data supporting the research is confidential.

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