Increasing Learning Motivation: An Empirical Study of VR Effects on the Vocational Training of Bank Clerks

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Abstract. Virtual reality applications in education are becoming more and more frequent. Empirical, data-based insights in the mechanisms and impacts of VR trainings are still sparse, however. With this quasi-experimental investigation, we compare the effects of a VR training game with a conventional face-to-face presence workshop in the field of vocational training. The training domain is awareness and customer interaction training for bank clerks. The results show that the VR solutions excelled the expectations of participants and the learning motivation was significantly higher as opposed to the conventional training. In the perceived effectiveness, the VR conditions achieved equal results than face-to-face workshops. The results provide evidence that VR solutions are an appropriate approach for vocational training.

Keywords: Virtual Reality, Games, Vocational Training

1 Introduction

Virtual Reality (VR) is increasingly acknowledged as a serious means of education; VR provides powerful immersion and rich interaction [1, 2]. VR learning environments allow students to manipulate objects and parameters, and makes it possible to replace or expand real world learning environments [3]. Students can benefit from VR observing otherwise unobservable phenomena, in virtual worlds that provide a high sense of environmental, physical and social presence [4, 5].

The use of VR goes back to the 1960's in the entertainment industry [6], and, since then, has gained attention in various fields (gaming , flight simulation, higher education, surgery, construction management, weld training, military, etc.) [7, 8, 9, 23, 24, 25]. Device cost was a problem for a long time, but the high level of immersion that VR provided was considered to increase students' motivation [10], engagement, learning focus and time ever since - including its potential to decrease time for skill mastery, to lower material use, and to gain performance outcomes. However, VR in education is still at its developing stage. Despite years of research, scholars argue it will still take time to bring VR to the classroom [20]. Educators still need to understand the underly-

ing pedagogical mechanisms and to identify design strategies that enhance learning experiences for broader use [11]. There is a clear lack of empirical evidence showing VR's educational value [3]. Furthermore, the large part of studies focus on acquiring and practicing physical skills; only few studies focus on learning social skills, for example studies on cultural awareness, e.g. in military operations [27], distance counselling [28] and interpersonal problem solving [29].

Literature typically distincts between low immersion and high immersion VR [14]. Low immersion VR is also referred to as "desktop VR". The virtual environment is displayed on a computer display with sound coming through speakers, while the interaction with the virtual world is controlled through a computer mouse [3]. Most studies that investigate educational benefits focus on this type of low immersion or desktop VR [2]. Even though desktop VR cannot provide a fully immersive virtual experience, photorealistic computer graphics have shown to enhance learners' engagement [15]. The use of low immersion VR, in contrast to high immersion VR, is much cheaper because of the drastic reduction in the cost of devices. Empirical studies and meta-analyses have shown desktop VR to result in better cognitive outcomes and attitudes toward learning compared to more traditional teaching methods [2, 16, 17] and to have greater motivational value [18, 19].

High immersion VR is characterized by the use of a head-mounted-display called VR headset, which provides room-scale virtual reality and 360-degree coverage immersion experience [20]. The interaction in the virtual environment is controlled through head-motion. There is little empirical evidence that high immersion VR increases cognitive and motivational outcomes, compared to desktop VR [21, 22]. However, there is limited and inconclusive research regarding the question whether higher immersion leads to greater levels of presence, therefore better outcomes in learning, and transfer than is achieved by desktop VR [2].

The aim of the present study is to investigate the effects of a high-immersion VR training solutions in a field where "soft", interpersonal skills are supposed to be practiced in combination with acquired rather declarative knowledge. The VR solution is compared to a conventional face-to-face (f2f) training solution. The domain is the training of bank clerk's behavior sets to be attentive and engaging with bank customers. We hypothesize that the participants using VR training will be more satisfied, more motivated to learn and will believe to learn more (perceived effectiveness) than participants in traditional f2f trainings.

2 A Quasi-Experimental Study

2.1 Participants

In total, 46 bank clerks of an Austrian bank participated in the study. One group (34 participants) was trained traditionally with a f2f presence workshop (F2F group), while the second group (12 participants) was trained using a high immersion VR training game (VR group). Participants were between 19 und 54 years old (M = 26.56, SD = 8.84) and there was no significant age difference between the two groups (t = -.73,

p = .467). In the f2f group, 19 participants were female and 14 participants were male, in the VR group, 9 participants were female and 2 participants were male. The participants of the VR group had more average work experience in their current job (M = 9.18, SD = 10.27) than the participants in the traditional group (M = 3.24, SD = 3.77; t_{44} = -2.91, p = .006), but the two groups did not differ in their general work experience (t_{44} = 0.146, p = .885), which showed an average work experience of about 7 years. Participants were provided through a cooperation with a bank.

2.2 Materials and Procedures

The f2f group was trained by traditional learning methods like direct instructions and lectures during a one-day presence workshop. There were three one day classroom trainings, with 10 to 15 participants each (frontal lecture, exercises and role-playing). The VR group was trained by using high immersion VR game. The VR training took place in a bank office. Training was followed by a questionnaire that each participant had to complete, containing some sociodemographic questions followed by the BFI-10 [30] to assess their Big Five personality traits. The next questions assessed the participants' motivation (7 items), their usage of digital media (7 items), what they thought about the training method (46 items), how they prefer to learn (6 items) and what kind of expectations they had about the training session (2 items). The VR group additionally had to complete questions regarding their interaction with the virtual world and the VR-headset (15 items). The answers to all the questions were given with a 5-point Likert scale from "*strongly agree*" to "*strongly disagree*".

2.3 The VR Training Game

The VR game was produced by eLearning agency *CREATE.21st century* in collaboration with an Austrian bank. Financial domain experts contributed to the development of training content and game dramaturgy. The game is set in a bank branch. VR learners follow a bank employee taking care of a client (from first contact to contract signing). Learners enter the virtual environment, which is based on a 360° video of a bank branch. Actors take the role of customers and a bank clerk. Learners follow the scenarios in the virtual environment and interact with the actors. Participants are able to make decisions, which are reflected in the interaction between the bank employee and the client. The VR training lasts approximately 30 minutes. Technically, the scenario has been developed with Unity3D for Oculus Rift.

The VR game's (and the f2f workshop) aim was to improve bank clerks' attention to customers, argumentative skills and sensitivity for cross-selling. Moreover, the training focusses on increasing the declarative knowledge about customer interactions and practicing this knowledge.

Figure 1. Insight the VR glass: Bank clerk attending client.
User is feedbacking the action using a joystick

3 Results

In a first step, we analysed the background variables of participants. Overall, the majority of the participants use digital media quite often at work and in their private life. Also, the participants strongly believed that digitization has a significant impact on their work (*M = 2.05* on the 5-point Likert-scale; *SD = 1.06)*.

Table 1. *Learning preferences*

	Books and texts	Videos and movies	YouTube tutorials	Search engines on smartphone	Direct contact with teachers
strongly agree	15 (32.6%)	13 (28.3%)	11 (23.9%)	32 (69.6%)	15 (32.6%)
agree	6 (13%)	8 (17.4%)	7 (15.2%)	8 (17.4%)	16 (34.8%)
undecided	14 (30.4%)	10 (21.7%)	6 (13%)	3 (6.5%)	10 (21.7%)
disagree	4 (8.7%)	8 (17.4%)	11 (23.9%)	-	1 (2.2%)
str. disagree	3 (6.5%)	3 (6.5%)	8 (17.4%)	-	1 (2.2%)
missing	4 (8.7%)	4 (8.7%)	3 (6.5%)	3 (6.5%)	3 (6.5%)

Participants were also asked about their preferred way to learn (see Table 1). Interestingly the majority of participants indicated that they thought that the most effective way to learn is by being in direct contact with teachers and trainers. The majority of the

participants stated that they could not imagine participating only in online/virtual trainings (*M = 3.33; SD = 1.57*). There was no difference between the traditional and the VR group regarding this statement ($t_{41} = 1.76$, $p = .087$). In turn, many participants were undecided regarding the question if they see the future of training in the digital or virtual world - a large part agreed with this statement, with a significant difference between the traditional group and the VR group ($t_{41} = 4.40$, $p < .001$). The VR group agreed more with the statement that they see the future of further training in the digital or virtual world (*M = 1.42, SD = 0.90*) than the traditional group (*M = 3.20, SD = 1.28*).

Satisfaction, expectation and perceived effectiveness: Our main results show three notable differences between VR and f2f groups.

First, the majority of participants stated that their *satisfaction* with the training session were met or even surpassed (see Figure 1). However, we observed a significant difference between the traditional group and the VR group ($t_{41} = 4.34$, $p < .001$). The VR group was significantly more satisfied with the training session ($M = 2.46$, $SD = 0.45$) than the traditional group ($M = 2.09$, $SD = 1.18$).

Second, we analysed the trainings' *perceived effectiveness*. Both groups, VR and f2f, perceived their training as similarly effective. The self-assessed effectiveness was slightly higher in the f2f group, with, however, no statistically significant difference ($p = .135$).

Third, analysing trainees' *expectations* towards their training resulted in a significant difference between VR and f2f groups. This finding is the most distinctive one we observed. In VR groups, participants' expectations were met (and excelled) significantly stronger than in f2f groups ($t_{41} = 3.22$, $p < .001$; cf. Figure 1).

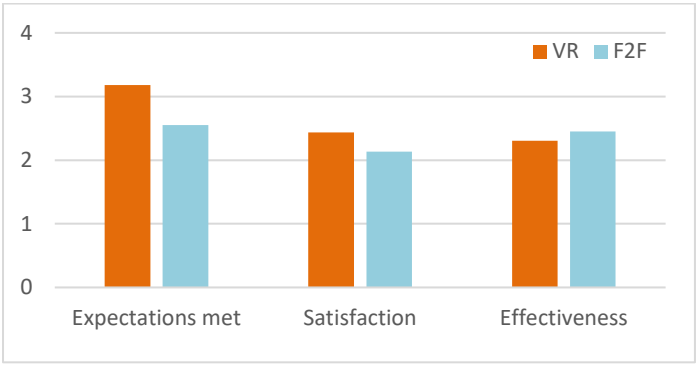

Figure 3. Comparison of VR and f2f groups.

There were no significant differences between the f2f and the VR group in any of the personality traits (Extraversion: $t_{43} = 1.79$, $p = .080$; Agreeableness: $t_{43} = 0.31$, $p = .755$; Conscientiousness: $t_{43} = .35$, $p = .732$; Neuroticism: $t_{42} = 0.18$, $p = .857$; Openness: $t_{42} = 0.562$, $p = .577$). Thus, there is no reason to believe that any of the other examined differences between the two groups in this study are the result of personality differences between the traditional group and the VR group.

Motivation: There were significant differences between the f2f group and the VR group in their *motivation* (t_{42} = 2.38, p = .022) and their thoughts about the training method (t_{44} = 4.82, p < .001). The VR group perceived their training as more motivating (M = 1.48, SD = 0.36) than the f2f group (M = 1.89, SD = 0.55). The VR group also perceived their training as more positive in general (M = 1.43, SD = 0.33) than the f2f group (M = 2.52, SD = 0.75).

4 Conclusion and discussion

The aim of this study was to investigate whether a high immersive VR training game can be a solution for vocational training, by this concrete example, in the banking sector. We hypothesized that VR leads to higher learning *satisfaction*, perceived learning *effectiveness* and *motivation*. Our results show that, in our experimental setup, participants who used VR training were generally more satisfied with their training, were more motivated to learn and perceived their learning outcomes as greater than f2f participants. There are some influencing factors that may explain these results:

First, **personality traits**: For example, one may hypothesize that introverted participants are more satisfied with a training method like VR. In fact, we collected qualitative feedback that hints at such aspects. Some participants reported the typical f2f workshop elements, specifically role-playing acts, can be perceived as displeasing. In the past, they felt uncomfortable when being requested to perform a role-play with others, who were mostly strangers. This can be considered an indicative and important strength of VR training scenarios. When shifting displeasing or disruptive elements of a training into the virtual world. Since there were no differences between the two groups in personality traits, it can be assumed that the difference in motivation and training scores could be attributed to such aspects of the different training methods.

Second, the VR solution's **novelty** may also have had an effect, especially when it comes to trainees' expectations. Blandly said, it is harder to excel the expectations of a f2f training, which is a known standard approach. In contrast, VR may excel expectations easier due to its novelty. However, since VR is not yet a standard approach in vocational training, it is highly likely that a novelty effect may occur across studies with a similar setup. Hence, "novelty" will be a VR attribute for some time being, which may fade away only with the technology's broader uptake in education. Educators may use novelty effect as an attribute to motivate and satisfy learners for their educational purposes.

Third, **learning time**: The VR session lasted 30 minutes. In contrast, f2f participants spent one day in a workshop room. One may hypothesize that participants are generally more satisfied and motivated when spending less time in trainings, independently from the didactical approach. Our findings, however, show that f2f participants were satisfied with their training and found it effective, too. Furthermore, despite the large difference in training time demand (30 minutes vs. 1 day workshop), both VR and f2f participants found their training similarly effective. Therefore, we assume that the effects observed as rather independent from training time, but more a result of the training method itself.

In conclusion, it appears that VR training methods are an appropriate means of educational and training. In a medium to long-term perspective, VR and AR will become a serious part of the educational landscape. With the present study, we contribute empirical evidence for the advantageous characteristics of VR solutions. Further research will increase the sample size, evaluate different VR designs. as well as VR trainings transferability to the real world.

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