



Article

# VRChances: An Immersive Virtual Reality Experience to Support Teenagers in Their Career Decisions

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**Abstract:** In this paper, we present a tool that offers young people virtual career guidance through an immersive virtual reality (VR) experience. While virtual environments provide an effective way to explore different experiences, VR offers users immersive interactions with simulated 3D environments. This allows the realistic exploration of different job fields in a virtual environment without being physically present. The study investigates the extent to which performing occupational tasks in a virtual environment influences the career perceptions of young adults and whether it enhances their understanding of professions. In particular, the study focuses on users' expectations of an electrician's profession. In total, 23 teenagers and eight application experts were involved to assess the teenager's expectations and the potential of the career guidance tool.

**Keywords:** virtual reality; career guidance; job simulation; unemployment



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## 1. Introduction

Choosing a career path is an important decision in a person's life and forms the basis for their future direction. It impacts the future career and influences financial stability, as well as the person's well-being. Many people struggle to find out what they are interested in and talented in, making it difficult to choose a fitting career path. Therefore, the decision-making process requires careful consideration, self-reflection, and exploring numerous options. New forms of working and learning driven by digitalization are already omnipresent in companies and are constantly confronting teenagers and young adults with new challenges. The gap between traditional training content and the rapidly changing work environment is expanding at an unprecedented rate [1]. Nevertheless, this agile and networked world promotes innovative ideas and concepts that will shape the future of workplaces. Career choices in today's labor market are characterized by a wide range of options. This diversity offers individuals the freedom to find careers that suit their preferences, interests, and abilities [2]. However, the decision-making process is often influenced by the dynamic and evolving nature of work environments, where technological advancements, economic shifts, and organizational changes result in uncertainty factors. These factors can vary across industries and regions, making it essential to consider specific contexts when discussing career decision-making challenges. To decide on a career path, it is crucial to consider both the available career options and one's skills and preferences. Therefore, a major aspect of career decision-making is identifying an option that suits one's goals and characteristics [3]. Young people often report stress or feeling insecure when confronted with a wide range of career opportunities and that it is difficult to meet the different expectations. This difficulty is compounded by the lack of a detailed understanding of various professional fields, making it difficult for them to imagine the typical tasks of different jobs [4]. The

gap between young people's established career expectations and the real job requirements varies. This underlines the need for a new approach to the didactic preparation of these materials. Virtual reality (VR) emerges as a promising tool, offering a unique approach to exploring various professions and determining the best fit. It is an advanced form of human–computer interface that allows users to interact with and become fully immersed in computer-generated environments [5]. VR provides a sense of presence and immersion, making users feel like they are part of the virtual environment rather than just observing it from the outside. This level of immersion is typically achieved through head-mounted displays and other sensory feedback devices, which are already being utilized across various fields such as healthcare [6], therapy [7], architecture [8], and manufacturing [9]. VR has received notable recognition, especially in educational and training environments, because of its ability to transform learning from passive to active [10]. In the medical field, VR training has helped improve the efficiency of surgical procedures [11]. Additionally, a meta-analysis by Villena-Taranilla et al. [12] has highlighted the substantial positive impact of immersive VR on student learning outcomes in K–6 education. In the field of Chemical Engineering, VR has been successfully used to enhance student engagement and understanding, demonstrating its potential to improve learning experiences by simulating real-world industrial systems that are difficult to access in traditional classrooms [13]. Furthermore, VR games can also be used to replicate realistic work environments [14]. It is suggested that VR games can serve as valuable additional tools for predicting work performance. VR enables users to perform realistic simulations of various environments, tasks, and challenges, allowing them to gain practical insight into different professions [15]. Aurangzeb et al. [16] highlighted that career guidance involves techniques and processes designed to help students understand work opportunities and career development. VR technology, particularly through the utilization of 360-degree videos, has proven to be a promising approach for career guidance. Research indicates that they can effectively aid in career development, occupational information acquisition, and self-reflection if the quality of content and physical side effects are carefully managed [17,18]. In terms of career orientation for teenagers, a VR simulation could offer an interactive platform for exploring various jobs and industries in a realistic and engaging manner. By providing young job seekers with the opportunity to navigate through virtual work environments, VR can empower them to make more informed decisions about their future careers. However, there are some limitations and challenges that have to be addressed when creating an immersive VR experience. This includes costs, time restrictions, and motion sickness [19].

In this paper, we present the development and evaluation of 'VRChances', an immersive virtual job simulator designed to assist teenagers in career guidance. The study aims to evaluate the effectiveness of virtual reality in career guidance and to understand its impact on adolescents' perceptions and decisions regarding their career paths. This research builds on previous studies, where we explored immersive environments and their impact on student participation in educational activities, including a game-based approach to engage adolescents in computer science activities [20], as well as immersive learning methods [21]. The results highlight the potential of VR in creating engaging, hands-on learning experiences. We extended this work by applying VR in a practical setting for career guidance. To assess the effectiveness of VR in career guidance, we posed the following research questions:

- RQ1: How does performing occupational tasks within VR affect teenagers' job understanding and expectations?
- RQ2: How effective is VR in assisting teenagers with their career choices?

By addressing these questions, we seek to determine how immersive VR experiences can enhance career guidance for young adults, providing them with valuable insights and aiding them in making informed career decisions.

**Contribution:** This paper presents an immersive virtual job guidance tool to support young adults in job decisions. The focus is on the job scenario of an electrician. The study involves an expert and user evaluation involving five job coaches with experience

supporting and guiding teenagers in their career choices, three professional electricians, and 23 teenagers from different social and cultural backgrounds seeking a job. The focus is on examining the impact on teenager's expectations and their understanding of career paths, as well as the effectiveness of the presented tool.

The following section provides an overview of the background and related work in career choices focusing on tools that assist people in their decision-making process. In Section 3, we introduce the immersive virtual job guidance tool, the interaction, and the included job scenarios. Section 4 describes the study design, including an expert and user evaluation, followed by Section 5 describing the results. In Section 6, we discuss the results and outcomes in context with the current literature. Section 7 summarizes the key findings and their implications and suggests future work.

## 2. Background and Related Work

To understand career choices and decision-making, it is crucial to examine the factors influencing individual decisions and the tools that can aid in this process. This section provides an overview of the literature on career choice and decision-making, emphasizing the key factors that impact career decisions. Additionally, it explores the potential of emerging technologies, especially virtual reality (VR), in enhancing educational and training experiences, as well as career decision-making.

### 2.1. Career Choice and Decision Making

Choosing a career is a pivotal decision for many individuals. This process of career selection is a special case of decision-making [22]. Decision-making is about navigating through multiple options to determine a course of action, which involves identifying, evaluating, and selecting alternatives according to personal beliefs, values, and preferences. The career choice process involves considering many occupational fields and narrowing them down until ultimately committing to one [23]. Job choice decisions are influenced by job attributes, organizational factors, and individual characteristics. Feldman and Arnold [24] underline the importance of job factors such as salary, fringe benefits, and the use of skills and abilities while highlighting the influence of organizational factors such as flexibility and the type of services provided. Newton et al. [25] also reported that salary is an essential driver of job choice for both men and women. McGraw et al. [26] identified job responsibilities, work environment, and family time as crucial factors, particularly in the context of professionals choosing between academic and government employment. The role of social context, serendipitous events, and immediate social influences, particularly from parents, has been highlighted as significant in shaping career decision-making [27]. Kulkarni and Nithyanand [28] emphasized the importance of social influences in job choice decisions, particularly among young job seekers. They found that social comparisons and the opinions of peers and seniors significantly impact job decisions. Additionally, factors like career advancement opportunities, personal growth, and the desire to create impact act as strong motivators in choosing specific career paths [29]. Practical experience can also play a factor in this process. Husain et al. [30] emphasized the importance of internships in degree programs and noted that interns find these experiences valuable in their career choices. Internships offer insight into actual jobs, helping individuals determine whether a particular career matches their interests and preferences.

### 2.2. VR in Education and Training

Due to evolving technologies, new methods for exploring career paths have emerged, for example, in the form of VR. It was found that playing a video game in virtual reality is just as difficult as on a desktop screen, but evokes stronger emotional responses and a stronger sense of presence [31]. Therefore, VR games offer a great opportunity to simulate different environments. Slavova and Mu [32] have shown that the inclusion of VR as a complementary tool, along with traditional learning methods, can improve learners' ability to understand and recognize concepts. The active interaction with learning

content has proven to be an effective method for improving learning outcomes [33]. Recent research indicates that interactive VR simulations in education have a positive effect on aspects such as motivation and enjoyment [34]. They have the potential to boost interest and perceived value [35] and are typically more entertaining and engaging than traditional video-based learning, especially when combined with generative learning strategies where students actively apply their knowledge [36]. Moreover, immersive VR has been shown to significantly enhance learning gains compared to non-immersive video, with users reporting higher levels of enjoyment and concentration [37]. Petersen et al. [38] further explored the underlying processes of learning in VR environments, highlighting the role of interactivity and immersion in shaping cognitive and affective outcomes. They found that these VR features positively influenced situational interest, cognitive load, and embodied learning.

### 2.3. VR Tools for Professional Training

Nowadays, virtual reality presents numerous opportunities for professional training. VR use cases for small and medium enterprises include safety instructions and staff training [39]. Virtual hands-on experiences are considered more efficient than traditional methods, as they lead to higher retention rates. In industrial settings, VR has shown great potential, particularly in training and engineering processes, by providing immersive, interactive environments that enhance learning effectiveness [40]. Additionally, VR's success in safety and emergency training scenarios underscores its practicality and cost-effectiveness in improving safety training outcomes [41]. A virtual reality electrician experience presented by Wen and Gheisari [42] suggests a subsequent improvement in attitude towards electrical work. In terms of training, a replica of the real production facility can help users familiarize themselves with their environment [43]. Furthermore, VR training is a cost-effective way to eliminate real-world risks through simulation and avoids interrupting production [41]. These applications can also provide additional training opportunities when there are only very few real-world skill acquisition opportunities [44]. VR enables trainees to experience and practice under realistic conditions that are difficult to replicate in traditional training settings [45].

### 2.4. VR Simulations for Career Guidance

Job Simulator (<https://jobsimulatorgame.com/> (accessed on 15 July 2024)) is a VR video game in which players participate in comical approximations of real professions. In a world where robots have replaced all human jobs, players experience what it was like to work as a cook, office worker, or mechanic. The game provides extensive creative freedom in task completion and allows a spectator mode where others can view a person playing the game. Simons et al. [14] investigated the relationship between the game results and the results of an intelligence test to discuss the applicability of VR to the assessment of personnel using the Job Simulator game. They showed that participants who completed the game faster had a higher level of intelligence and processing capacity than others, suggesting that VR games could be valuable supplementary tools to predict job performance. However, Job Simulator aims to entertain the user and not to provide realistic job simulations. Fominykh and Prasolova-Førland [46] have proposed the concept of immersive job tasting by using virtual reality applications to give unemployed people insights into various career paths by providing VR examples of typical day-to-day tasks. These VR job experiences can have a high perceived usefulness [15]. However, these applications can also provide challenges to institutions like unemployment offices, such as VR hardware vendors' policy changes or privacy concerns [47]. Fominykh and Prasolova-Førland have also shown a virtual reality application for job choice intervention and training specifically for fishery and other maritime vocations [48]. Several companies have developed virtual reality job training applications, such as Senselab.io (<https://senselab.io/grundlagen-e-installation/> (accessed on 15 July 2024)) or Vobling (<https://vobling.com/electricalvrtraining> (accessed on 15 July 2024)), who have both created VR electrician training software intended to be used by



prospective electricians. In these applications, the user learns about basic wiring and fuse boxes; the latter application also features installing light switches, for example. The Sliced Bread Animation company (<https://sbanimation.com/case-studies/vr-training-for-cooks/> (accessed on 15 July 2024)) has developed educational software for trainee chefs with a focus on teaching specific cooking techniques for five dishes, such as combining butter and water at the right speed when cooking Hollandaise Sauce. Research also suggests that VR cooking training software has a positive effect on the learning outcome of students [49].

### 3. Virtual Job Guidance

VRChances is an immersive and interactive job experience environment developed in collaboration with a local social service provider to address young adults from different social and cultural backgrounds. It is implemented in Unity (<https://unity.com> (accessed on 1 July 2024)), a widely used cross-platform game engine supporting the creation of 3D graphics, virtual reality, and simulations. Unity facilitates the import of assets and their assembly into virtual scenes and comes with an integrated physics engine that handles forces such as acceleration, collisions, and gravity. The application is designed as an extendable framework that provides different immersive and engaging tasks and hurdles a worker has to deal with in a certain job. The application provides teenagers and young adults with real-life scenarios without any associated risk due to its simulated nature, allowing them more freedom when working and experimenting. This allows users with optimal conditions to learn about various jobs in an engaging atmosphere. When starting the application, the player is located in a lobby room where a virtual guide welcomes the user and leads them through the experience. To enable interactions with certain tools and objects in VR, we used the package AutoHand (<https://www.earnestrobot.net/unityassets/autohand> (accessed on 1 July 2024)). It is a VR physics interaction system that supports Unity XR, SteamVR (<https://www.steamvr.com/> (accessed on 1 July 2024)), and Oculus integration (<https://developer.oculus.com/downloads/package/unity-integration/> (accessed on 1 July 2024)), allowing it to run standalone on Meta Quest or any devices supported by SteamVR. The package includes automatic pose generation, a movement controller, teleportation, and a collision guard system. Users can move freely within a predefined play area, enabling natural navigation within the virtual environment. To handle larger distances, users have to use the teleport system via the controller. The user presses a button on the controller to activate a colored laser beam that is pointed at the desired destination. Releasing the button then teleports the user to the selected location. The controller button mapping is displayed on a wall and explains how to move and interact with the environment. The different job scenarios are accessible as disks placed in a virtual vending machine from which the user can select the desired scenario by entering the respective number and pushing the handle on the machine. After inserting the disk into the slot of a virtual console, the user gets teleported to the selected job scene where the experience starts. Figure 1 shows the lobby room with the guide and the job disk vending machine. At the beginning of each job scenario, a robot guide assists the user and explains the different tasks to be completed. Each scenario is a designed educational experience that mimics scenarios in real-world job environments. These scenarios are structured to gradually introduce users to the complexities of a specific job role, starting with simpler tasks and progressing to more challenging ones. The experience starts with a clean-up quest in which the user has to pick up and sort relevant tools to perform the job tasks. Interactable objects in the scene are highlighted with a solid outline when a quest requires their usage. The outlines are visible from any point in the scene and are not obstructed by other objects. It should help players find their tools easily, especially in the initial phase. The guide explains the tools the player has to look out for and what quests to do, including multiple sub-quests that have to be solved. After completing the first beginner tasks, the user has to apply the newly gained knowledge. However, if the player gets lost, there is always the opportunity to interact with the guide to get hints and support. In the end, the player is given a final task

and needs to complete it under certain conditions like time pressure or a slightly changed end goal.



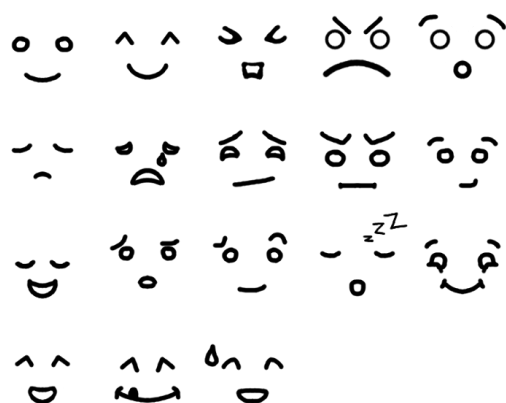
**Figure 1.** Main menu scene for the job selection.

### 3.1. Guide Interaction

A fundamental element of each job scenario is the guide interaction system. The system features a virtual robot that acts as an instructor guiding users through the virtual environment. The guide physically navigates to the position where the next task is to be performed, enhancing spatial awareness and providing clear direction. This capability ensures users are correctly oriented within the virtual space and know precisely where to focus their attention. The guide provides step-by-step instructions for completing specific tasks or activities and presents relevant information about the scenario, task, and tools. The guide interaction system includes a dialogue view and a hint view to display messages and additional instructions if needed. Figure 2 illustrates the interaction with the dialog and hint system. The blue hand symbol indicates an available hint and opens the hint view when the user touches it. Pressing the button next to the dialog box allows the user to navigate through the dialog. By delivering feedback, the guide helps users stay on track and prevents them from making common errors. The guide's facial emotions change based on the user's behavior, creating a more dynamic and engaging experience. If the user makes a mistake, the guide responds with a displeased emotion and provides further immediate feedback in a dialogue. Figure 3 displays all available emotional reactions that the guide can show in different situations (e.g., happy, angry, proud, and disappointed).



**Figure 2.** Guide interaction via dialogue view and hint view.



**Figure 3.** Guide emotions based on the player behavior.

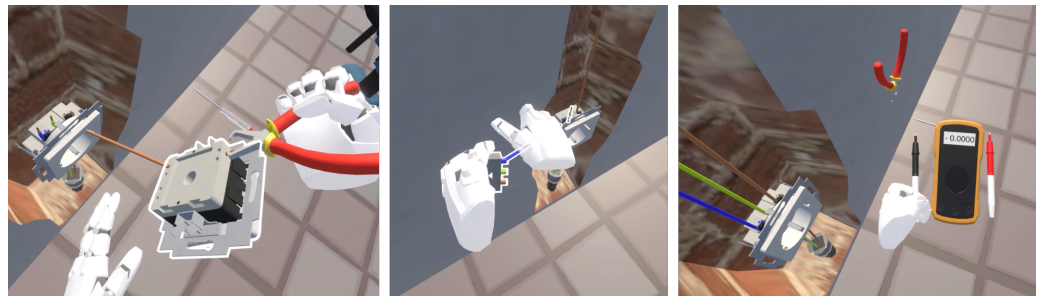
### 3.2. Job Scenarios

To evaluate teenagers' job understanding and expectations in a user study, as well as the effectiveness of the tool in supporting their career choices, we implemented two job scenarios requiring certain skills and abilities. The professions of an electrician and a cook were chosen, as they represent diverse skillsets foundational that are in their respective fields, providing teenagers with insights into both technical and practical career paths. The aim is to broaden the perspectives of teenagers on potential career paths while evaluating how well they align with their interests and aspirations.

*Electrician:* In this scenario, users are placed in a garage to perform the fundamental tasks of an electrician: installing power sockets and switches. Figure 4 shows the scenario environment, including a workbench, tools, sockets, and measurement devices. During the game, users are given an introduction to the tools and tasks performed by an electrician. Users should acquire basic knowledge for mastering similar tasks under real conditions considering safety instructions. Initially, the guide introduces the quest and the required tool set that is required for solving the task. Figure 5 shows different interactions with tools such as a power socket, a wire connector, or a multimeter. Users can access these objects via a toolbox with drawers categorized based on their usage. Additionally, users can adjust the height and placement of the toolbox according to their preferences. Following the guide introductions, the first hands-on task starts with the installation of a simple power socket, where the user has to strip the wires and connect them to the corresponding phase, neutral, and ground plugs. Concerning safety measures, users have to take care of the fuse box where they have to flip the circuit breaker to work safely with the wires or to measure the voltage of a socket. In the next step, the guide asks the user to extend the current installation using a switch that can be used to switch the light in the room on and off. After achieving this goal, the guide encourages the user to implement a multiway switch, i.e., the connection of two or more switches to control the lights from more than one location. In this final task, the users must apply the previously gained knowledge to replace the simple switch with two multiway switches.



**Figure 4.** Electrician job experience in a garage setting.



**Figure 5.** Interaction with a power socket, a wire connector, and a multimeter.

*Cook:* The second scenario takes place in a kitchen scene where users have to perform simple cooking tasks: cutting vegetables, weighing ingredients, and preparing dishes. Figure 6 shows the scenario environment that includes two stoves, a sink, a kitchen counter, utensils, and ingredients. Similarly to the electrician scene, the gameplay starts with an introduction to the different utensils used during the tasks by sorting them in the scene. Users should gain basic skills to handle similar cooking tasks in real-life scenarios within time constraints. In the scenario, users are asked to prepare two dishes for a certain number of guests within a given time frame. The first dish requires the user to cook and serve a soup in a bowl. For the second dish, the user has to mix a pancake batter, cook a pancake in a pan, and serve it with jam on a plate. The guide provides step-by-step instructions and recipes, assisting users throughout the whole cooking procedure. The user's task is to accurately prepare the right ingredients in the correct amounts, where some ingredients have to be cut and others weighed using a kitchen scale and then mixed. For cutting ingredients, we used the Unity OpenFracture (<https://github.com/dgreenheck/OpenFracture> (accessed on 1 July 2024)) package, allowing realistic mesh slicing. Figure 7 illustrates the various interactions within the kitchen scene, showcasing activities such as cutting vegetables, weighing flour, and rolling pancakes. The scenario also includes a progress indicator to show if the food is being prepared correctly and features the possibility of burning food if not cooked properly. These interactive elements are designed to provide an immersive and educational experience, helping players develop practical cooking skills that can be applied in real-life situations.





**Figure 6.** Cook job experience in a kitchen setting.



**Figure 7.** Cooking interactions: Cutting vegetables, weighing ingredients, cooking and rolling pancakes, ladling soup.

#### 4. Study Design

The goal of this study was to evaluate the effectiveness of VR in career guidance. Beyond measuring user satisfaction, we aimed to explore how VR can improve professional awareness. For the evaluation, the electrician scenario was chosen due to its inherently complex and potentially dangerous tasks that are difficult to recreate safely in traditional training environments. By simulating these tasks in VR, we provide a more immersive and engaging training experience, especially for young adults interested in in-demand, hands-on career paths where safety and precision skills are essential.

The following variables were defined to address the research questions: the independent variables were the user group [experts, teenagers], and the dependent variables were the job expectations [skills, outlook, opinion]. The study was divided into two parts: (1) An expert evaluation with job coaches and people who work as electricians and (2) a user evaluation with teenagers seeking a job. The research design included pre- and post-intervention assessments. Given the specific context of the job choice and the profession of an electrician, customized questionnaires with self-designed questions were used. Additionally, an expert and trainer evaluation was conducted.

##### 4.1. Material and Setup

To recruit participants, teenagers, and coaches from a job orientation course offered by a social service provider, as well as electricians from a local facility management department,



were invited to take part in the study. Participants were provided with a Meta Quest 2 device running the VR experience as a standalone application. Each user had a designated free play area of at least  $2\text{ m} \times 2\text{ m}$ . Up to three participants were tested simultaneously in the same room. The participants were free to move within the predefined area, although they were advised to use teleportation if needed due to space limitations. Users had the opportunity to communicate with the study guides and ask for help if they encountered difficulties while using the application.

AI-assisted tools were used to expand the literature review and to enhance the text quality. Specifically, scite\_ was utilized to broaden the literature review, while ChatGPT was used to improve text paragraphs. The use of these tools is disclosed in order to ensure transparency.

#### 4.2. Expert Evaluation

To evaluate the potential and usefulness of the application, we conducted an expert review with both job coaches and professional electricians. The aim of the expert evaluation was to determine whether the VR application effectively covered the nature of the electrician profession and whether it could serve as a supplementary tool for career guidance.

*Methodology:* Before testing the application, the experts were required to fill out a pre-questionnaire covering demographic information, such as gender, age, education, and their experience with computers, video games, and VR. Participants were also asked to rate their knowledge of the electrician profession on a Likert scale between 1 (little) and 5 (high). In further questions, they were asked to describe the typical tasks of an electrician, the skills and qualifications a person would need to work in this field, their perception of the job outlook, and gender expectations regarding the job. In addition, professional electricians were also asked about common salaries in their field. After finishing the pre-questionnaire, the VR experiment started, where the participants had to perform the different quests included in the job experience. Participants were encouraged to engage with the VR application for at least 30 min. Afterward, the participants were asked to complete a post-questionnaire in which the experts had to rate six items on a Likert scale from 1 (strongly disagree) to 5 (strongly agree) concerning their satisfaction and perceptions. Finally, an open-ended question was included for suggestions for improvement. The complete questionnaire for the expert evaluation is included in the Appendix A.1.

*Participants:* Five job coaches (one male and four females) with experience in supporting and guiding young people in their career choices were recruited as part of the expert review. The coaches were aged between 27 and 56 and had completed upper secondary education. In addition to the job coaches, three professional electricians (three males and 0 females) aged between 41 and 58 were recruited. Two had completed lower secondary education (LSE), and one had a university degree. In the pre-questionnaire, we asked the participants to rate their experience with computers, video games, and VR on a Likert scale from 1 (low) to 5 (high). Both expert groups rated their computer knowledge as moderate and their experience with video games and VR as low. The job coaches ranked their knowledge about an electrician as average and the electricians themselves as high. Table 1 gives an overview of the expert demographics and experience levels of the expert group.

**Table 1.** Information on the demographics and the experience levels of the expert participants on a Likert scale between 1 (low) and 5 (high).

	Age	Gender	Level of Education	Experience with ... Computers	Video Games	VR	Electrician
C1	27	F	Uni	3	2	1	2
C2	37	F	Uni	4	1	2	3
C3	46	F	Uni	4	1	2	1
C4	56	F	Other	3	2	2	3
C5	28	M	Other	4	4	2	3
E1	47	M	LSE	3	4	3	4
E2	58	M	Uni	2	1	1	4
E3	41	M	LSE	3	2	2	4

#### 4.3. User Evaluation

A user study was conducted to investigate the research objectives, examining how teenagers' perception of the profession of electricians changes after engaging with VR-Chances. This user evaluation should also assess the understanding of the electrician occupation of the participants before and after using the VR application, as well as whether it supports them in making an informed career choice.

*Methodology:* The user evaluation closely resembled the expert evaluation but included some variations in the questionnaires. The pre-intervention questionnaire for teenagers began with the same sociodemographic questions. Afterward, queries about their knowledge of the electrician profession, rated on a Likert scale from 1 (little) to 5 (high), along with their salary expectations and preferred working hours, were asked. Participants were also instructed to list three words associated with electricians and subsequently provide descriptions of the tasks involved, necessary skills, perceptions of job outlook, and gender expectations in an open-ended format. Finally, participants indicated whether they aspired to work as electricians. Following a 30 min session in the electrician scenario of VRChances, the post-intervention questionnaire asked the teenagers to reassess their knowledge of the profession using the same Likert scale. They were again prompted to list three words associated with electricians. Open-ended questions revisited topics such as tasks, required skills, job prospects, and gender expectations to gauge any changes in perceptions after the VR experience. Lastly, participants were asked to reflect on whether their opinions about the profession had evolved and if they now harbored aspirations to pursue a career as an electrician. The entire questionnaire for the user evaluation is included in the Appendix A.2.

*Participants:* The study included 24 adolescents and young adults from a local social service provider (16 males and eight females), between the ages of 15 and 21 years (AVG = 17.22, SD = 1.62). These participants were a diverse group of people with a wide array of often socioeconomically disadvantaged backgrounds who had participated as part of the career counseling service of the aforementioned social service provider. A total of 14 of the participants had completed lower secondary education, while 9 had completed upper secondary education. The user's reported ratings of their experience with computers, video games, and VR on a Likert scale from 1 (low) to 5 (high), indicating an average familiarity with computers (AVG = 3.43, SD = 0.95) and a high level of experience with video games (AVG = 4.05, SD = 0.79). Their self-assessed experience with virtual reality was below average (AVG = 2.23, SD = 1.15). One participant dropped out due to visual impairments related to wearing glasses and was therefore excluded from the evaluation results.

## 5. Results

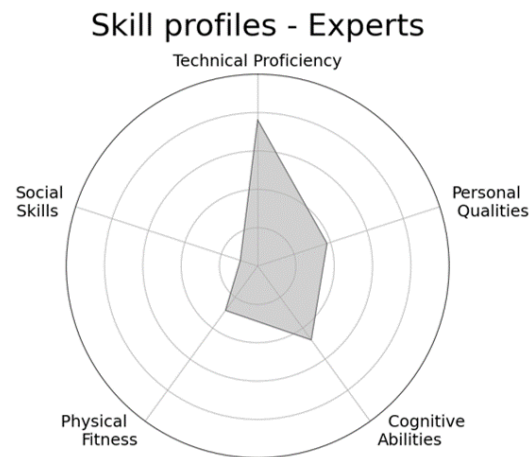
In the following section, we present the results of the expert and user evaluations, focusing on users' potential, suitability, and expectations regarding the chosen job field. We conducted a sentiment analysis to understand users' perceptions, specifically looking

at the positive and negative sentiments associated with the job and its future potential. Additionally, we performed the Wilcoxon signed-rank test to identify statistically significant differences in teenagers' self-assessed knowledge about the job before and after using the VR application.

### 5.1. Expert Review

When asking the job coaches about the tasks of an electrician, they mentioned installing, repairing, and maintaining electrical systems, circuits, and cables. This included power sockets, doorbells, and lightning conductors, which align with the descriptions given by the electricians. In addition to installation and maintenance, the electricians described tasks such as laying cables, connecting circuit boards, troubleshooting, pulling cables, and testing electrical components. They highlighted skills such as interest, attention, concentration, and willingness to learn. The coaches pointed out that technical and mathematical understanding, good hand-eye coordination, logical thinking and problem-solving skills, and the ability to read plans are important for the job. To visualize the skill profile, we used a radar chart generated using the Python library matplotlib. (<https://matplotlib.org/> (accessed on 15 August 2024)). Figure 8 shows the recommended skills profile of an electrician according to the experts' answers, which have been normalized and categorized into five categories: technical proficiency, personal qualities, cognitive abilities, physical fitness, and social skills. The job prospects for electricians were described as attractive with many job offers. The job coaches underlined the demand for electricians due to ongoing digitization and new forms of technology and multimedia. They described the job prospects as "very good" and "promising" and noted many open positions in this field, resulting in a relatively good employment situation for electricians. The electricians themselves agreed with this statement, referring to the increased use of electricity in all areas. They saw their job as a "profession with a bright future". Electricians rated their career prospects as "very good", reflecting the rising need for qualified professionals to support growing infrastructure and technical progress. In addition, both coaches and electricians underlined that the job is equally suitable for boys and girls to learn. The job coaches emphasized that the most important factors for success in this field are interest in the profession and motivation. They conceded that there are currently more males in this field, but they highlighted that the job does not have gender-specific requirements. Electricians conceded that there are still educational barriers that can affect girls' participation in this field. Despite these barriers, there was a consensus that the profession is inclusive and offers opportunities for all, regardless of gender. The average monthly salary for an electrician was reported as 2300 EUR after deductions.

Table 2 presents the results of the post-questionnaire conducted among coaches and electricians, evaluating the VR application on a Likert scale from 1 to 5. It provides a comparative view of the perception of the application by the two groups with different professional backgrounds. Both groups agreed that the application was enjoyable and generally reasonable. Although coaches reported moderate satisfaction, electricians indicated a higher level of satisfaction. Both groups strongly agreed on the application's usefulness and its value as an addition to existing career guidance methods. The coaches rated the content selection as well chosen and aligned with the objectives, which the electricians also positively evaluated. However, coaches' perceptions of the clarity of content presentation varied more than those of electricians. In general, both coaches and electricians generally rated the career guidance application positively, with electricians expressing slightly higher satisfaction and stronger agreement on most aspects. Both groups would strongly recommend the application.



**Figure 8.** Most frequently mentioned skills that an electrician needs according to the experts.

**Table 2.** Survey results of the coaches and electricians on a Likert scale between 1 (strongly disagree) and 5 (strongly agree).

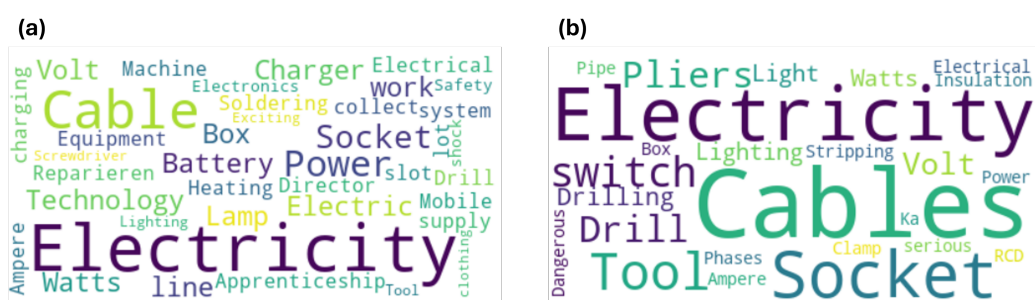
Item	Coaches		Electricians	
	AVG	SD	AVG	SD
I was satisfied with the application.	3.20	0.45	4.33	0.58
It is a good idea to use this application for career guidance.	4.60	0.55	4.67	0.58
It is a good addition to regular career guidance methods.	4.60	0.55	4.67	0.58
The content was well selected and was in line with the objective.	4.80	0.45	4.67	0.58
The content was presented in a clear and structured way.	3.60	0.89	4.33	0.58
I would recommend this application.	4.40	0.55	4.67	0.58

### 5.2. User Job Expectations

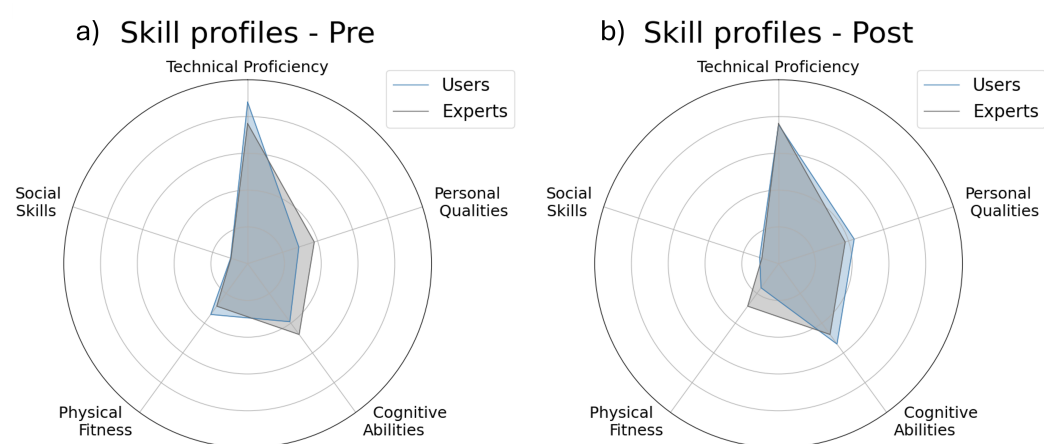
The user evaluation findings provide information on the job expectations of adolescents and young adults in the chosen job field considering the usage of VRChances. Before starting the experiment, the participants reported low familiarity with the profession of electricians (AVG = 1.9, SD = 0.97). The majority (20 participants) preferred regular working hours, while 2 preferred shift work and 1 wanted to work on weekends. On average, the participants expected a net salary of 2096.36 EUR (SD = 589.15) for an electrician. Initially, 4 of the 23 participants expressed interest in working as an electrician. After the VR job experience, three maintained this interest, while one changed their mind and would no longer work in this field. When asking the users about the first three words that come to mind when thinking about an electrician, they named various terms before exploring the VR experience. After experimenting with VRChances, the variety of different answers shrunk. To visualize these changes, a word cloud was produced using the Python library WordCloud ([https://amueller.github.io/word\\_cloud/](https://amueller.github.io/word_cloud/) (accessed on 15 August 2024)). It provides a visual representation of the most frequently mentioned terms. Figure 9a shows a word cloud of the mentioned words associated with an electrician before the VR session, while Figure 9b shows the associated words afterward. Words that are displayed larger were mentioned more frequently. “Electricity” and “Cable” were most often named before and after the job experience. After performing as an electrician in VR, several participants mentioned words like “Socket”, “Tool”, “Drill”, “Pliers”, and “Switch”, resulting in a sharper profile of the profession. To evaluate the effectiveness of the VR job guidance tool, a comparison of the pre- and post-questionnaire responses on the knowledge about the job was conducted. The participants increased their knowledge from pre (AVG = 1.91, SD = 0.97) to post (AVG = 2.48, SD = 1.04). However, the results showed no significant difference in the self-assessed knowledge before and after playing VRChances (Wilcoxon signed-rank test:  $p = 0.097$ ).

**Task Expectations:** Before testing the VR application, users were also asked to describe the typical tasks and responsibilities of an electrician. The most common terms in their responses were “installations”, “power supply”, and “repair”. After testing VRChances, they were asked again to describe the work of an electrician. This time, participants described the tasks as dangerous, challenging, and strenuous, but also fun and exciting. Additionally, some users characterized the tasks as precise, physically demanding, and requiring clear-headedness. The tasks mentioned by the participants mainly reflected those they performed in the application, such as installing equipment, drilling, sorting tools, and working with insulation.

**Skill Expectations:** Figure 10 illustrates the skill profile that young adults considered essential for electricians before and after the VR experience. It summarizes the open-ended user responses, which were normalized and grouped into the same five skill categories used for the experts: technical proficiency, personal qualities, cognitive abilities, physical fitness, and social skills. Similar terms were grouped for clarity. Although technical proficiency was considered the most important skill category both before and after using the VR tool, terms in this category were mentioned slightly less often after using VRChances. Words indicating a higher perceived physical fitness required to be an electrician also appeared less often. In contrast, the frequency of terms associated with personal qualities and cognitive abilities increased subsequently. The number of mentions of terms related to social skills remained the same. As a result, the skill expectations of young adults after the VR experience resemble more closely the profile determined by experts.



**Figure 9.** Most frequently mentioned words when thinking of an electrician (a) before and (b) after playing the VR application.

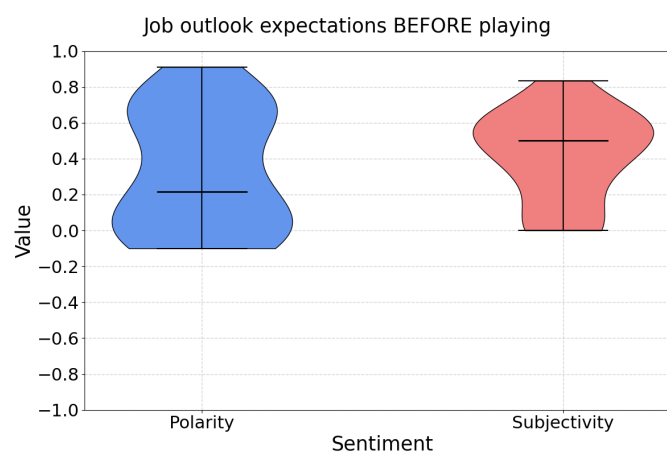


**Figure 10.** Most frequently mentioned skills that an electrician needs according to the experts compared against the users' responses (a) before and (b) after playing the VR application.

**Job Outlook Expectations:** Initially, there was a broadly positive perception of good job prospects and ease of finding work as an electrician. Participants highlighted the constant demand and the numerous opportunities through apprenticeships. After the job experience, there was a shift in responses. While some still saw good prospects and



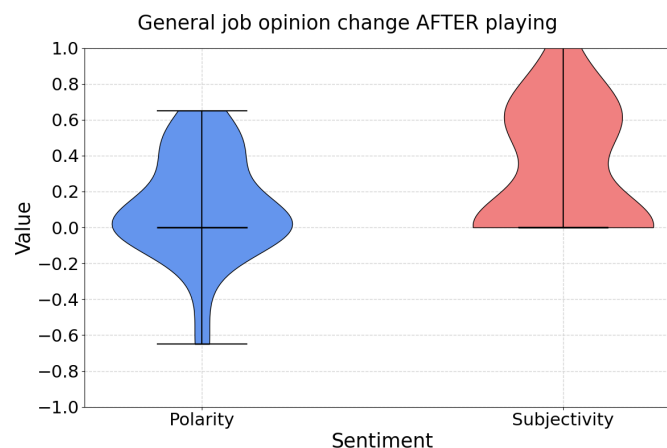
acknowledged the ongoing need for electricians, there was more caution and uncertainty expressed. Some noted challenges and a decrease in personal enthusiasm for pursuing a career as an electrician, indicating a more nuanced view after considering both the positives and potential difficulties of the job. To examine participants' opinions about job outlook expectations and any changes in their general job opinions after playing VRChances, we performed a sentiment analysis, including polarity and subjectivity scores using the Python library TextBlob (<https://textblob.readthedocs.io/> (accessed on 15 August 2024)). Figure 11 illustrates the user sentiment on their job outlook expectations before engaging with the application. The polarity score indicates the positivity or negativity of the feelings, while the subjectivity score measures the degree of personal opinion versus objective information. Initially, most adolescents perceived a promising future for the electrician job, with a median polarity score of 0.2, indicating a slightly positive sentiment. Afterward, many teenagers stated that their career outlook did not change, which resulted in the polarity score leaning towards zero, indicating a more neutral sentiment. The graphic representation of the sentiment analysis of the job outlook after the VR session can be seen in Figure 12. The sentiment analysis of the job opinion change after playing VRChances is presented in Figure 13. The results show a median polarity score of 0.0, indicating a neutral sentiment. The values range from  $-0.65$  to  $0.65$ , with a higher distribution for positive values. Similarly, the median subjectivity score is 0.0, suggesting mostly objective responses.



**Figure 11.** Sentiment on the job outlook expectations before playing the VR app with polarity from  $-1$  (negative) to  $1$  (positive) and subjectivity from  $0$  (objective information) to  $1$  (personal opinion).



**Figure 12.** Sentiment on the job outlook expectations after playing the VR app with polarity from  $-1$  (negative) to  $1$  (positive) and subjectivity from  $0$  (objective information) to  $1$  (personal opinion).



**Figure 13.** Sentiment on the job opinion after playing the VR app with polarity from  $-1$  (negative) to  $1$  (positive) and subjectivity from  $0$  (objective information) to  $1$  (personal opinion).

## 6. Discussion

This study aimed to assess whether a virtual reality job guidance application improves users' understanding of professions and how it can assist them in making career choices. The first research question RQ1 focused on the teenagers' job understanding and expectations. The results indicate a slight change in the perception of the skills required for the profession of an electrician after playing the job experience in VR. The user's skill expectations almost matched the view and descriptions given by the job coaches and professional electricians. Adolescents reported lower physical fitness and technical skill requirements after the VR experience but described the work tasks as dangerous, challenging, and strenuous. This shift in perception suggests that the VR application provided a more vivid and realistic understanding of the electrician's job. It might also indicate the mental or physical effort experienced by some users. Although this shift in perception suggests a change in users' understanding of the job, it is important to note that this conclusion is based on observed changes in users' descriptions. However, they described it as fun and exciting. The task descriptions of the participants after experiencing the VR application were more detailed and varied compared to their initial responses, indicating that the VR job experience enhanced their understanding of the electrician's role. The descriptions also corresponded similarly to the activities listed by the Public Employment Service Austria (AMS) [50]. The terms they used suggested a deeper understanding of the complexities and skills involved in the job and an awareness of the safety precautions required in this field.

### 6.1. Expert Insights and User Expectations

The expert insights and the tasks described by job coaches and electricians underscore the VR application's accuracy and relevance, which is a crucial aspect supported by Slavova and Mu [32]. Their research indicates that VR, when used as a complementary tool to traditional learning methods, can enhance learners' performance in understanding and recognizing concepts. Regarding research question RQ2, the positive feedback from coaches and electricians regarding the application's usefulness and alignment with career guidance objectives supports its potential as an effective tool for career exploration. Initially, users had limited familiarity with the electrician profession, and their expectations were somewhat misaligned with the reality of the job, as depicted in the VR application. Users increased their knowledge slightly (not significantly) and gained a clearer understanding after performing the practical tasks in VR. This aligns with findings from Husain et al. [30], who noted the importance of practical experience in career decisions. The shift in users' perceptions, as evidenced by the word clouds and skill profiles, suggests that the VR experience effectively broadened their understanding of the job's requirements and challenges. However, the unchanged interest in a career as an electrician after the VR experience indicates that VR can improve understanding but not necessarily increase the interest in

a profession. The VR application's success in providing a detailed and engaging representation of an electrician's tasks is consistent with previous research highlighting the effectiveness of immersive VR in enhancing users' comprehension of complex tasks and environments [37,38]. However, the Wilcoxon signed-rank test results showing no significant difference in self-assessed knowledge suggest that while users gained a clearer picture of the job, this did not translate into a perceived increase in knowledge. This discrepancy might be due to the complexity of the task overwhelming the users, making it difficult to assess their knowledge gain accurately.

### 6.2. Sentiment and Career Outlook

The participants expected an average net salary of around 2100 EUR, which is consistent with the reported 2300 EUR by the electricians and the average net salary of 2130 EUR provided by STATISTIK AUSTRIA [51]. This expectation may reflect teenagers' and young adults' understanding of the labor market and their economic aspirations. The correspondence between expected and actual salary underscores the importance of realistic financial expectations in career guidance, as salary is a decisive factor in career decisions. The sentiment analysis of the responses regarding job prospects for electricians before and after the VR experience reveals a shift in perceptions. Initially, respondents expressed generally positive views, with strong positivity and moderate subjectivity, indicating a belief in good job opportunities and the field's necessity. However, after using VRChances, the sentiments became less uniformly positive, with a noticeable decrease in average polarity and subjectivity. This shift suggests a more nuanced understanding of the challenges and suitability associated with the profession, leading to a more balanced overall view. The data highlight an evolution from initial optimism to a tempered perspective, reflecting a deeper contemplation of the complexities involved in pursuing a career as an electrician. Expert insights on gender inclusivity highlight the profession's suitability for both boys and girls, despite current gender imbalances. The VR application's role in presenting an unbiased view of the profession can be crucial in breaking down stereotypes and encouraging a more diverse range of candidates to consider a career as an electrician. The results support the claim that VR can serve as a valuable tool for career guidance by providing realistic job simulations that help users obtain a deeper understanding of different occupations [15,42,46]. However, it also highlights the need for further research into how these tools can influence career interests and long-term decisions. Moreover, addressing factors such as salary expectations, job satisfaction, and realistic job previews through VR can play a crucial role in career decisions.

### 6.3. Limitations

Although the study has shown promising results, it is important to consider the relatively small sample size of eight experts and 23 young job seekers when interpreting the findings. A larger and more diverse sample, as well as a knowledge inquiry that is not based on self-assessment, would strengthen the evidence supporting the conclusions. The study considered only one job scenario and did not involve other occupations. Future evaluations should consider more participants and a wider range of professions. Furthermore, a 30 min time limit was set for the participants to complete the tasks, in which only two users could successfully install a socket. Providing them with more play time could improve the effectiveness of the VR application. Even though we attempted to include many of the typical tasks an electrician or chef has to perform and tried to convey some basic knowledge required for these vocations, we just scratched the surface of these complex occupational profiles. The application could be extended to include various other tasks to give a better impression of the different jobs. Moreover, certain tasks may appear easier than they are in reality and therefore not properly represent the profession. Additionally, a VR experience is no full substitute for trying out a profession in real life. Certain factors such as interaction with colleagues, physical exertion at work, temperature, smell, taste, or other aspects of

the work environment could not be accurately portrayed but should be taken into account when choosing a career path.

## 7. Conclusions

In this paper, we introduced VRChances, a virtual reality application designed as a career guidance framework. The current implementation of VRChances allows users to explore the profession of an electrician, offering an immersive and interactive experience to enhance their understanding of this field. Although the study primarily focused on the electrician scenario, we also included a cook scenario to demonstrate the versatility and adaptability of the framework. By presenting both scenarios, we aimed to illustrate how the application can be tailored to different professions, highlighting its potential to meet a wide range of career guidance needs. We conducted an expert review and a study with job-seeking adolescents and young adults regarding the job expectations of the profession of electrician. The experts agreed that the application is a good addition to regular career guidance methods and offers well-selected content. While the VR job guidance tool has demonstrated its ability to improve users' understanding of the electrician profession, its impact on career interest remains limited. These findings highlight the difference between knowledge acquisition and career interest and indicate that VR can be used to effectively inform users about job fields, but the game did not directly influence their career choice. Additionally, after using the VR tool, the perceived required skills to be an electrician as reported by young job seekers also mostly approached the skills required as described by the experts. This alignment suggests that VR job experiences can help to overcome the gap between lay perceptions and professional practice. In conclusion, the results highlight the potential of VR in modern career education, offering a powerful tool to provide detailed, immersive, and realistic job insights. With continued refinement and research, VR career guidance tools can play a pivotal role in helping young adults make informed and balanced career decisions. Future research should focus on long-term studies to assess the sustained impact of VR career guidance tools on users' career choices and knowledge retention. It would also be of interest to investigate the effectiveness of offering a wide array of different professions to try out in a VR career guidance application. Incorporating healthcare, engineering, and creative positions can offer users a variety of insights into different career paths. By broadening the range of professions, users can be exposed to various career possibilities, potentially leading to more informed and confident career decisions. Additionally, exploring the integration of personalized feedback and adaptive learning paths within the VR experience could enhance its effectiveness. Further investigation of the gender-specific impacts of such tools could provide more insight into how career guidance can be better tailored to diverse audiences.

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**Conflicts of Interest:** Author Philipp Einwallner was employed by the Jugend am Werk Steiermark. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results. The authors declare no conflicts of interest.

## Appendix A. Questionnaires

### Appendix A.1. Expert Evaluation Questionnaire

The pre-questionnaire the participants of the expert evaluation filled out before using VRChances can be seen in Tables A1 and A2 shows the post-questionnaire.

**Table A1.** Expert evaluation pre-questionnaire.

#	Question	Answer Type
1	User ID	Number
2	Age	Number
3	Gender	male, female, other
4	Level of Education	Primary education, Lower secondary education, Upper secondary education, University degree, other
5	Rate your experience in the following areas: <ul style="list-style-type: none"> <li>Computers</li> <li>Video Games</li> <li>Virtual Reality</li> </ul>	1 (very poor)–5 (very high)
6	How familiar are you with the profession of electrician?	1 (hardly at all)–5 (very familiar)
7	What are the typical tasks an electrician has to perform?	Text
8	What skills are needed to work as an electrician?	Text
9	How do you see the job prospects for electricians?	Text
10	Do you think being an electrician is more of a job for boys, girls, or both? Give reasons for your answer.	Text
11	(Only for electricians) What is a common salary for an electrician?	Number

**Table A2.** Expert evaluation post-questionnaire.

#	Question	Answer Type
12	Rate the following statements: <ul style="list-style-type: none"> <li>I was satisfied with the application.</li> <li>It is a good idea to use this application for career guidance.</li> <li>It is a good addition to regular career guidance methods.</li> <li>The content was well selected and was in line with the objective.</li> <li>The content was presented in a clear and structured way.</li> <li>I would recommend this application.</li> </ul>	1 (strongly disagree)–5 (strongly agree)
13	What areas of the application could be improved? Do you have any other comments?	Text

### Appendix A.2. User Evaluation Questionnaire

The pre-questionnaire of the user evaluation, which was filled out before experimenting with VRChances, is shown in Table A3. After using the virtual reality application, the participants filled out a post-questionnaire, which can be seen in Table A4.



**Table A3.** User evaluation pre-questionnaire.

#	Question	Answer Type
1	User ID	Number
2	Age	Number
3	Gender	male, female, other
4	Level of Education	Primary education, Lower secondary education, Upper secondary education, University degree, other
5	Rate your experience in the following areas: <ul style="list-style-type: none"> <li>Computers</li> <li>Video Games</li> <li>Virtual Reality</li> </ul>	1 (very poor)–5 (very high)
6	How familiar are you with the profession of electrician?	1 (hardly at all)–5 (very familiar)
7	What salary expectations do you have for the job of an electrician?	Number
8	What working time preferences would you have as an electrician?	Regular working hours, Shift work, Weekend work
9	Name the first three words that come to your mind when you think of an electrician.	Text
10	What are the responsibilities of an electrician? What do you think are the typical tasks an electrician has to do?	Text
11	What skills does an electrician need in your opinion?	Text
12	How do you see the job prospects for electricians?	Text
13	Do you think being an electrician is more of a job for boys, girls, or both? Give reasons for your answer.	Text
14	Would you like to work as an electrician?	Yes, No

**Table A4.** User evaluation post-questionnaire.

#	Question	Answer Type
15	User ID	Number
16	How familiar are you now with the profession of electrician?	1 (hardly at all)–5 (very familiar)
17	Name the first three words that come to your mind when you think of an electrician.	Text
18	How would you describe the work of an electrician now?	Text
19	What skills does an electrician need in your opinion?	Text
20	How do you see the job prospects for electricians now?	Text
21	Has your opinion changed as to whether being an electrician is more of a job for boys, girls, or both?	Text
22	Has what you have learned changed your opinion of electricians? If so, how? What did you find most interesting or surprising?	Text
23	Would you like to work as an electrician now?	Yes, No

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