Design Methodology for Virtual Reality in Career Guidance and Vocational Education

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Document

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1. Introduction

1.1 Motivation

Many young people are not in education and out of work. Many of them spend time playing games that give them the feeling of mastery and positive feedback. For this generation, technology is a natural part of life, they are keen to use digital channels and social media to get information about potential study possibilities and jobs. At the same time, traditional professions and channels of communication 'lag behind' digitally and often rely on text-only presentation modes, so young people feel uncertain about the path they should choose and how and where to get a job. The meeting with work life can be terrifying to some job seekers, especially those with low level of vocational self-concept, low level of vocational self-efficacy, and social anxiety. Young people that have little experience with working life or negative experience often develop a low level of vocational decision-making competence which is crucial for mastering working life. Therefore, there is a need to explore new and more efficient ways to communicate with young job seekers through digital experiences and channels, as well as to facilitate engaging and safe working experiences.

We explore Virtual Reality (VR) as a new means for helping young people to take part in working life. VR broadens the possibilities for providing practical education. This technology is used to train skills that would otherwise require a lot of supervision, such as assembly tasks. Other use cases include creating a training environment that is dangerous or unachievable in real life, making resources and devices accessible with limited access, and making abstract learning concrete. VR technology can have positive effects on learning. For instance, VR can promote and facilitate learning, provided the technology is properly integrated into the learning process technically, didactically and content-wise. The immersion of the online environment offers a positive effect on engagement and learning pleasure.

1.2 Purpose

What is the purpose and the scope of this document?

This document serves as a design methodology for VR applications to be used in career guidance and vocational education. The document derives the methodology from the theory and practice of career guidance and vocational education. The methodology itself is thus informed by the theory and practice of this domain and provides design recommendations to the professionals who aim to design VR applications to be used in this domain. The methodology describes how the scenarios and content should be created for VR applications to be used in career guidance and vocational education. The methodology however does not describe in detail the design of VR software applications.

1.3 Target audience

For whom is this document?

This document is made for multi-disciplinary teams of professionals who are actively developing VR applications for career guidance and vocational education and training (VET). Professionals with the following competences should understand the guidance presented in this document and should work together on the development of such VR applications:

- Education, counseling, and experts of specific professions
    - Employees of welfare organizations who work with the unemployed
    - Teaching staff and technicians at VET organizations
    - Counselors and technicians at organizations that provide career guidance, such as career centers, municipalities, schools
    - Profession / industry stakeholders
- VR developers
    - Software developers
    - Graphics designers
    - Teachers and researchers at higher education institutions with interest in VR, VET, and counseling
    - Students at higher education institutions, especially, in study programs of computer science, educational sciences, and psychology

1.4 Structure of the document

This section of the document provided the motivation for using VR in career guidance and vocational education. It also describes the purpose of the document and describes who can use the methodology described in this document. Section 2 provides more background on the topics, answering the question why VR should be used in career guidance and vocational education. Section 3 describes the concept of Virtual Job Taste that is applied in the methodology, answering the question how VR applications should be used for career guidance and vocational education. Section 4 describes the design methodology itself. It provides detailed information and concrete steps for creating scenarios and content for VR applications that simulate workplaces and professions. Finally, section 5 provides an overview of connecting the Virtual Job Taste to the local work life and suggestions for integrating VR experiences into the practice in career guidance and vocational education.

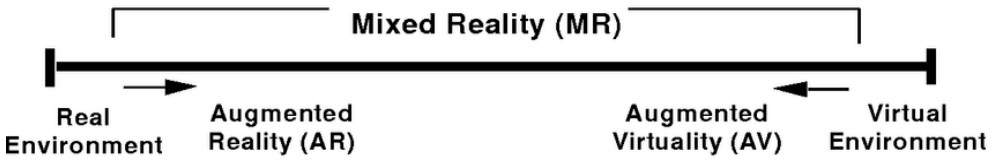
2. Background

This section provides background information necessary to understand the concept and effectively use the design methodology presented in later sections of the document.

2.1 Virtual Reality

What is Virtual Reality?

Milgram and Kishino's influential real – virtual environment continuum[1] (see Figure below) conceptualizes VR as an environment where the user is completely immersed in a virtual setting. In the context of this methodology document, we refrain from desktop-based VR environments occasionally mentioned in the literature, such as in Berki[2] and strictly adhere to VR experiences with head mounted displays or glasses. VR enables full authentic sensory immersion enabling students to experience often difficult-to-observe phenomenon in a risk-free environment[3,4], such as a tailored experience of a vocational domain, which would often be limited in an intern role or associated with risks in an employee setting. Such tailored experience is used as a tool for vocational education and can also be used in career guidance by providing potential students with a glimpse into the domain which can help them make critical career decisions.



Reality-Virtuality (RV) Continuum

2.2 Virtual Reality and Vocational Education

How is Virtual Reality used in vocational education and training?

VR has been widely adopted in various domains within vocational education to engage and motivate learners, decrease time to achieve skill mastery, cut down on material usage, and

[1] Paul Milgram and Fumio Kishino (1994) A Taxonomy of Mixed Reality Visual Displays https://globals.ieice.org/en_transactions/information/10.1587/e77-d_12_1321/_p
[2] Borbála Berki (2020) Experiencing the sense of presence within an educational desktop virtual reality http://doi.org/10.12700/APH.17.2.2020.2.14
[3] EL Mostafa Bourhim and Abdelghani Cherkaoui (2020) Efficacy of Virtual Reality for Studying People's Pre-evacuation Behavior under Fire https://doi.org/10.1016/j.ijhcs.2020.102484
[4] Sarah Morélot, Alain Garrigou, Julie Dedieu, and Bernard N'Kaoua (2021) Virtual reality for fire safety training: Influence of immersion and sense of presence on conceptual and procedural acquisition https://doi.org/10.1016/j.compedu.2021.104145

improve performance outcomes[5][6]. Vocational education is oriented to professions and emphasises skill training and practicality. Therefore, much of vocational education revolves around authentic practice and active learning of complex workplace skills. However, such education is often not feasible due to several factors such as training site, equipment, expert's time, safety etc. VR can provide an immersive, interactive, and authentic experience for students in vocational education to repeatedly train their skills in a safe environment. VR allows training in authentic settings that make experience closer to the actual real-world, including carefully designing the tasks, context, and environment[7]. Furthermore, VR also provides additional learning benefits, such as stimulating students to develop soft skills such as communication skills[8], provide real-time feedback etc. However, many VR applications have been developed without substantial reference to instructional methods or research on technology enhanced learning, seemingly reducing the acquisition of competence to a mode of trial-and-error[9].

2.3 The Four Component Instructional Design Model

What is 4C/ID and how is it used in vocational education and training?

One of the most prevalent instructional design models for training complex skills is the Four Components Instructional Design Model (4C/ID)[10]. Complex Skills are real-world skills which are characterised by their dependencies on multiple sub skills which together contribute to solving a complex problem. Complex skills cannot be fully automated by a machine[11]. The 4C/ID sees a considerable use in vocational education because of: (a) a focus on the development of complex skills or professional competencies, (b) increasing transfer of what is learned in school to new situations including the workplace, and (c) the development of 21st century skills that are important for lifelong learning. The 4C/ID model has been used to train complex skills using augmented reality in the context of medical

[5] Miriam Mulders, Josef Buchner and Michael Kerres (2022) Virtual Reality in Vocational Training: A Study Demonstrating the Potential of a VR-based Vehicle Painting Simulator for Skills Acquisition in Apprenticeship Training http://doi.org/10.1007/s10758-022-09630-w

[6] Miriam Mulders (2022) Vocational Training in Virtual Reality: A Case Study Using the 4C/ID Model https://doi.org/10.3390/mti6070049

[7] Victoria Lynn Lowell and Deepti Tagare (2023) Authentic learning and fidelity in virtual reality learning experiences for self-efficacy and transfer https://doi.org/10.1016/j.cexr.2023.100017

[8] Jang Hee Lee and Olga A. Shvetsova (2019) The Impact of VR Application on Student's Competency Development: A Comparative Study of Regular and VR Engineering Classes with Similar Competency Scopes http://doi.org/10.3390/su11082221

[9] Miriam Mulders, Josef Buchner, and Michael Kerres (2020) A Framework for the Use of Immersive Virtual Reality in Learning Environments http://dx.doi.org/10.3991/ijet.v15i24.16615

[10] Jeroen J. G. van Merriënboer, Richard E. Clark and Marcel B. M. de Croock (2022) Blueprints for complex learning: The 4C/ID-model http://doi.org/10.1007/BF02504993

[11] Bibeg Hang Limbu (2020) Multimodal interaction for deliberate practice https://research.ou.nl/en/publications/multimodal-interaction-for-deliberate-practice

training, astronaut training, and engineering[12]. It has also been used with VR in the context of vocational training for vehicle painting[13].

The basic assumption of the 4C/ID is that complex skills learning can be described in terms of four components[14], namely:

- *(Learning) tasks*: whole task experiences based on authentic tasks
- *Supportive information*: helps students with performing the non-routine aspects of learning task
- *Procedural information*: information that is prerequisite to the routine aspects of learning tasks and is provided in just-in-time fashion
- *Part-task practice*: additional exercises for routine aspects of (learning) tasks for which a very high level of automaticity is required

With the help of the 4C/ID instructional design framework, we can design holistic learning experiences in the context of vocational education. In the context of designing VR applications, this should allow users not to have pre-existing knowledge or require continuous support. It should also allow the users to transfer the learning into real-world applications.

2.4 Career Guidance

What does career guidance practice include?

Different life phases will entail different challenges when it comes to career. A career is not something that can be clarified and chosen early in life, as the frames of reference for the choices one makes will constantly change. Career guidance should therefore be about enabling everyone to take control of their life and their choices and should include a learning perspective where helping the individual have the prerequisites to handle career-related challenges throughout life is a clear goal[15]. Norwegian National Quality Framework for Career Guidance (NQCG)[16] defines career guidance as activities aimed at improving people's career competence. Career competence is competence that enables

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[12] Bibeg Limbu, Mikhail Fominykh, Roland Klemke, Marcus Specht and Fridolin Wild (2018) Supporting Training of Expertise with Wearable Technologies: The WEKIT Reference Framework http://doi.org/10.1007/978-981-10-6144-8_10

[13] Miriam Mulders, Josef Buchner and Michael Kerres (2022) Virtual Reality in Vocational Training: A Study Demonstrating the Potential of a VR-based Vehicle Painting Simulator for Skills Acquisition in Apprenticeship Training http://doi.org/10.1007/s10758-022-09630-w

[14] Jeroen J. G. Van Merrienboer and Liesbeth Kester (2014) The four-component instructional design model: Multimedia principles in environments for complex learning http://dx.doi.org/10.1017/CBO9781139547369.007

[15] Peter Plant and Erik Hagaseth Haug (2018) Unheard: the voice of users in the development of quality in career guidance services https://doi.org/10.1080/02601370.2018.1485058

[16] Gry Eilen Bakke, Line W. Engh, Ingjerd Espolin Gaarder, Tonje F. Gravås, Erik Hagaseth Haug, Anne Holm-Nordhagen, Torild Schulstok and Rie Thomsen (2020) National Quality Framework for Career Guidance https://hkdir.no/en/rapporter-undersokelser-og-statistikk/national-quality-framework-for-career-guidance-presentation-of-the-areas-of-competence-standards-career-competence-and-ethics

people to handle life, learning and work, also in changes and transitions. It is competence to know and understand oneself and one's context, to act and make choices, and to handle dilemmas and tensions related to life, learning and work. It is an attention to the fact that the individual is shaped by his life conditions and their actions but can also at the same time influence and shape his own and the community's future. Career guidance provides an opportunity to explore an individual's situation, wishes and opportunities, and provides support for actions, decisions and social participation. The goal of a career guidance practitioner or a career counsellor is to develop career competence in individuals via systematic counselling.

NQCG as a framework attempts to formalise and define systematic counselling in the generic context. For example, NQCG defines competence standards for career guidance practitioners, such as knowledge of career specific theories and methods, to ensure high quality service to the clients. Such competencies are independent of the domain but are universally applicable across all career guidance practices. Similarly, career guidance practitioners may provide their services on an individual or group basis, either physically or digitally, and within the framework of a range of sectors and organisations. Irrespective of the domain of application, a career guidance practitioner leads career guidance processes, provides career information, and facilitates career learning. Career guidance processes involve activities around helping clients better able to manage transitions and make meaningful choices relating to education, learning and work. A practitioner systematically structures the career guidance process while providing support for action and decisions by working with the client to identify and explore their situation and needs, evaluating and selecting formats, tools and methods that could be relevant in guidance.

2.5 Virtual Reality in Career Guidance Practice

How can Virtual Reality be used in career guidance?

A VR application can be an additional tool in the career guidance practitioner's arsenal which is better suited to meet the demands of modern, often complicated vocational domains. Using such tools, they can impart career information onto the individuals, a process which involves preparing and communicating information relating to education, learning, job and career. VR experience can simplify this communication by providing an engaging active simulation of a workplace which can enhance assimilation of career information and better equip individuals to make career decisions. Furthermore, such an experience can provide individuals with sufficient information to ascertain autonomy of their career learning and play an active role in planning and following their career paths. It also helps in transfer, which is the improvement of learning in a new task through the transfer of knowledge from a similar and related task that has already been learned (from VR to real similar tasks in everyday life). All this will also influence mastery, confidence, and self-efficacy which will play a part in their motivation.

2.5 The DOTS Model

What are the skills developed in career guidance?

Career guidance practice takes place most often in physical environments in school, universities, unemployment services and career centers. In some cases, there are digital career guidance practices which are mostly limited to using digital conversations tools such as chat, e-guidance and similar[17]. Career guidance practice, both physical and digital, typically analyzes an individual's characteristics, interests, skill sets, work values, and experience. Specific sets of tools are used to help individuals get to know and understand themselves and the work environment to help them make career and/or educational decisions[18]. Such tools can be interest-, skill-, or work-value inventories. These tools are combined with guidance from a career counsellor in a group or on an individual basis[19]. The main goal is to provide people with four main skills, also called DOTS model[20]:

- *Decision making skills* can be defined as the ability to make good choices. This includes knowledge about different ways of choosing, how the client chooses and awareness of what kind of choices are purposeful in the specific situation.
- *Opportunity awareness skills* can be defined as knowledge about what kind of opportunities exist, knowledge about what these opportunities can imply, and how to act.
- *Transition learning skills* can be defined as skills in managing challenges that are related to transitions, for example from education to working life, from one job to another or from working life to education.
- *Self-awareness skills* are defined as the ability to identify interests and needs and knowing their own competence. To be able to develop self-awareness skills one must have a good understanding of themselves as a person, what strengths and weaknesses one has, and awareness on which working life demands and expectations one has.

These four skills will provide people with knowledge and skills that will make it easier for them to make career and life decisions in the future.

The challenge with today's career guidance practice, and especially for young job seekers, is that they have very little experience with working life, do not know what to expect, has not been able to develop a vocational self-concept, may have a low confidence about themselves in terms of what they can do and what opportunities will fit them. Moreover, some may not

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[17] Erik Hagaseth Haug, Tristram Hooley, Jaana Kettunen, and Rie Thomsen (2020) Career and Career Guidance in the Nordic Countries http://doi.org/10.1163/9789004428096

[18] Mary McMahon and Wendy Patton (2022) The Systems Theory Framework of career development: News of difference and a journey towards acceptance https://doi.org/10.1177/10384162221120464

[19] Steven D. Brown and Robert W. Lent (2020) Career Development and Counseling: Putting Theory and Research to Work https://www.wiley.com/en-us/Career+Development+and+Counseling%3A+Putting+Theory+and+Research+to+Work%2C+3rd+Edition-p-9781119580348

[20] Bill Law (2001) New DOTS: Career Learning for the Contemporary World: https://www.hihohiho.com/memory/cafnewdots.pdf

have developed the capacity to reflect on what may fit them in working life. For people to develop decision making skills, opportunity awareness, transitions learning skills and self-awareness skills in appropriate manner, they must have been reflected over and have some real-life experience that can guide them in the career guidance process. Therefore, there is a need for developing new career guidance tools and career education tools so that young job seekers can experience what fits them in working life and that can contribute to reflecting and developing the skills mentioned above.

2.6 Virtual Reality for Career Development Skills

How can Virtual Reality facilitate the acquisition of career development skills?

VR can potentially improve the career guiding process. Using VR applications in career guidance allows realistic immersive experience that is not readily available in a traditional physical (and most digital) career guidance practice. VR applications that simulate workplace and job activities can flexibly provide young job seekers with an active and immersive experience that can potentially improve their understanding, attitude and perception of work and work-life, consequently leading to the development of the four career development skills:

- *Decision-making skills*: For young job seekers with low levels of vocational self-concept, self-efficacy, and little experience of choosing between jobs, VR experiences can have a positive effect on their ability to make choices and increase knowledge in what way they pursue their choices.
- *Opportunity awareness skills*: For young job seekers with low level of opportunity awareness, a VR experience can have a positive effect on developing knowledge of what type of opportunities exist in different professions, what these opportunities may imply, and the skill to update their awareness of the job market.
- *Transition learning skills*: For young job seekers the transition from unemployed to entering work life can be experienced as difficult and daunting. A VR experience can give them the opportunity to be exposed to a glimpse of work life in a safe environment, try out different jobs, learn about them, and contribute to decrease their negative experience of transition.
- *Self-awareness skills*: For young job seekers with low level of vocational self-concept, a VR experience can have a positive effect on developing an understanding of what specific interests they would like to pursue in their work life, what strengths and weaknesses one has in the specific jobs and professions, and if they can master the demands and expectations in the different job types and it matches their perception about them self and work.

The DOTS model is also used to assess the current standing of the young job seekers in terms of their career searching skills. This is often difficult to do in a face-to-face context where the young job seekers may be reserved or not yet open to the counsellor. VR experience can help career counsellors assess the young job seekers in a stealth manner, at an early stage. This enables the counsellor to make more informed decisions and design a

personalized path at an earlier stage overcoming some of the hurdles that are faced during the *conversation starter* sessions.

2.7 Supporting the DOTS Model Skills with Reflection in Virtual Reality

How to support the acquisition of career development skills in Virtual Reality applications?

VR can support the learning outcomes in the DOTS model by providing vocational training, and therefore support employability. It is also important to be aware that the four elements influence each other. For example, *I have got insight into what the job requires of me* (opportunity awareness), will influence readiness for transition into employability, increase insight into vocational identity (self awareness), and influence and give insight into *why and how I have decided to choose this path in my career*. Also it is not always a need to work with all of the four elements.

One way to support learning goals in DOTS is to include reflecting questions in the VR experience that users can reflect about during the VR experience or after:

- *Decision making awareness*: Help trainees develop effective decision-making skills regarding their career and vocational training.
    - Which factors are most significant to you when you choose a job path? How do these influence your choice?
    - Did the feedback on performance give you insight in your desire to choose this type of work?
    - Has your decision making strategy changed in any way in trying out the VR experience?
    - Did different work tasks give you insight in your choices for work, and did it make any difference and insight in choice?
- *Opportunity awareness*: Increase trainees' awareness of the various vocational opportunities, roles and working environments available to them in different industries.
    - What did you learn about the work environment and job roles while in VR? How does this align with your interests?
    - What insights did you gain from the industries you explored in VR? How can these insights help you pursue your future development of working skills in these sectors?
    - Did the feedback from your performance in the different tasks increase your innsight for the different jobs? How do they impact your career plans in the future?
- *Transitions awareness*: Equip trainees with the skills and knowledge needed to transition smoothly into the workforce.
    - What areas do you need to improve so that the transition from VR to actual physical work experience will go smoothly?
    - Did feedback on performance give you any insight on what is important to learn so that the transition becomes easier?

- *Self awareness*: Foster a deeper understanding of trainees' strengths, values, and motivations for the specific professions and industries.
    - What are your strongest skills? How can you leverage them in the VR app?
    - In what way can VR increase your self awareness and vocational identity?
    - What values are most important to your work? How do these values fit with the professions and industries you explore in VR?
    - Did feedback on performance give you insight in your skills, motivation and value?

2.8 Motivation in Career Guidance with Virtual Reality

What do theories say about motivating young job seekers and how to support it?

The perceived intrinsic motivation of young job seekers is fundamental to their decision-making process to pursue a career in the domain of interest. The young job seekers need to be intrinsically motivated, i.e., they must develop an affinity towards the domain relevant tasks and their decisions must be driven by the intrinsic desire to pursue a career in that domain. Such intrinsic motivation depends on the young job seekers beliefs or expectancy in their abilities to be successful at the career and the value he affixes to the task, Expectancy-Value theory[21] (EVT).

According to EVT, *Expectancy* refers to the young job seekers' beliefs in determining the outcome of the task. In a VR job experience, their interaction with the task can be closely monitored and the VR application can provide the necessary interventions when needed to ensure that they are successful in the task. *Value* simply refers to how much the young job seekers value the task. For example, is the task enjoyable, is it important etc. Value extends much further beyond the VR experience which is where career counsellors play a critical role. However, in a VR experience, with a meticulously designed instructional intervention, value can be inferred with strategies, such as gamification.

Motivation can also be viewed from the lens of Self-Determination theory[22] (SDT) which defines motivation from the perspective of an individual's innate psychological needs, more specifically, the need for competence, autonomy and relatedness. SDT assumes that people are driven by their need for growth, i.e., mastery, experience etc, and that intrinsic motivation is vital is long term sustainability of that behavior. *(Perceived) Competence* is the individual's feeling of mastery which can be supported via optimal challenges, structure, feedback etc. *(Perceived) Autonomy* is the feeling of being in control which can be supported by providing a rationale for engaging in the behavior and simply not forcing them to act in a certain manner. *(Perceived) Relatedness* is the feeling of being connected to others or understanding the value of the activity in the larger context.

[21] Allan Wigfield, Katherine Muenks and Jacquelynne S. Eccles (2021) Achievement motivation: What we know and where we are going https://doi.org/10.1146/annurev-devpsych-050720-103500
[22] R. M. Ryan and E. L. Deci (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being https://doi.org/10.1037/0003-066X.55.1.68

Use of VR can have potential positive effects on cognitive and intrinsic motivational aspects of career decision making and learning[23]. In addition, VR experiences can also be used to study factors that affect intrinsic motivation. Starr et al. found that only those who identified with the provided job experience (STEM, in this case) were likely to pursue STEM as a career[24]. Evidently, VR experiences can be used to intervene on the intrinsic motivational factors of young job seekers' job attitude. This is beneficial to career guidance, as VR can help young people to realize and identify with a career in a domain by providing an authentic and positive experience that nurtures their intrinsic motivation to pursue work in that domain.

2.9 Gamification as a Means for Motivation in Virtual Reality

How can gamification be used to support motivation of young job seekers?

Gamification is often used to foster motivation in players[25]. Brower & Conboy hypothesized how gamification design elements influence motivation according to the EVT[26]. EVT driven gamification approaches to intrinsic motivation can potentially increase the affinity of young job seekers at the end of the VR experience.

Like EVT, SDT of motivation has been used frequently in the context of gamification and game-based learning to foster motivation[27,28]. SDT focuses on the three basic psychological needs that drive intrinsic motivation, namely, Competence, Autonomy, and Relatedness. Frankie Tam states that SDT provides an empirical motivational framework for informing design decisions on game design elements to provide supportive environments for psychological needs: Competence (points, levels, optimal challenges, clear goals, feedback), Autonomy (avatars, narratives, opportunities for meaningful choices and actions), and Relatedness (interpersonal play, collaboration and cooperation, non-player characters)[29].

Gamification has been criticized for over relying on extrinsic motivation. This criticism is based on the definition of using game-elements outside games without altering the core

[23] Guido Makransky, Stefan Borre-Gude, ans Richard Mayer (2019) Motivational and Cognitive Benefits of Training in Immersive Virtual Reality Based on Multiple Assessments http://doi.org/10.1111/jcal.12375

[24] Christine Starr, Barrett R. Anderson and Katherine A. Green (2019) "I'm a Computer Scientist!": Virtual Reality Experience Influences Stereotype Threat and STEM Motivation Among Undergraduate Women http://doi.org/10.1007/s10956-019-09781-z

[25] Patrick Buckley and Elaine Doyle (2014) Gamification and student motivation https://doi.org/10.1080/10494820.2014.964263

[26] Robin Brouwer and Kieran Conboy (2017) A Theoretical Perspective on the Inner workings of Gamification in the Workplace https://ceurspt.wikidata.dbis.rwth-aachen.de/Vol-1978/paper3.html

[27] Mariya Shiyko, Sean Hallinan, Magy Seif El-Nasr, Shree Subramanian, Carmen Castaneda-Sceppa (2016) Effects of Playing a Serious Computer Game on Body Mass Index and Nutrition Knowledge in Women http://doi.org/10.2196/games.4977

[28] Jessica Ulmer, Sebastian Braun, Chi-Tsun Cheng, Steve Dowey and Jörg Wollert (2022) Gamification of virtual reality assembly training: Effects of a combined point and level system on motivation and training results https://doi.org/10.1016/j.ijhcs.2022.102854

[29] Frankie Tam (2020) Understanding Motivation in Games – Self-Determination Theory https://www.redwhiteconsole.net/motivation-games-self-determination-theory/

structure of the gamified context. However, we do not limit ourselves to the extrinsic nature of motivation in gamification but also embrace opportunities to foster intrinsic motivation by using SDT as the driving framework for motivation in addition to the use of game elements[30]. However, we cannot rule out the role of extrinsic motivators in young job seekers' decisions to pursue a career in the domain as well.

It should be noted that *mastery of the skill is not the goal* of the VR experience in career guidance. Extrinsic motivators will likely not play a role in the long-term sustainability of the career, but they may play a crucial role in supporting the tangibility of the intrinsic motivation in the short term. For example, while monetary incentive in a job may sound as an extrinsic motivator at first glance, it plays a key role in intrinsic motivation of an employee in the long-term. Monetary compensations are not a part of the experience VR promises, but in establishing the value aspect to get the young job seekers intrinsically motivated in the short term, extrinsic motivators can play a significant role.

[30] Robin De Croon, Davina Wildemeersch, Joris Wille, Katrien Verbert and Vero Vanden Abeele (2018) Gamification and Serious Games in a Healthcare Informatics Context https://doi.org/10.1109/ICHI.2018.00014

3. Virtual Job Taste: Concept

How can Virtual Reality be used in career guidance and vocational education?

This section presents an original concept for "Virtual Job Taste" and how VR applications designed based on this concept can be used in career guidance and vocational education.

3.1 Capturing the domain

The core objective of the VR applications in our context is to provide young job seekers an authentic experience of the day-to-day activities of the domain. Authentic settings in this context includes, but not limited to, workspaces, tasks, and skills. Therefore, to simulate an authentic experience, the Virtual Job Taste methodology must be able to capture and simulate real-life settings of the vocational domains.

Capturing workspaces

Workspaces are physical and conceptual spaces in which tasks within a domain are regularly performed. Workspaces can be ethnographically captured with the help of various technologies such as spherical 360 videos, images or photogrammetry. Experience capturing technologies can also be used to record physical spaces, humans and their performance, which can then be presented to the user so that this workplace experience can be re-experienced. Furthermore, such 'captured' workspaces form the steppingstone for the design of authentic experiences in the Virtual Job Taste. However, such recordings are complex which may require a variety of sophisticated technologies often only used in laboratory settings, such as 3D scanning and motion capture to truly capture the physical world and the performance. Recording of activities and experiences can, however, also be done by using durable sensors in real work environments[31]. Such recordings can also be used in VR but may require a different approach. Regardless, the selection of technology used to capture workspaces is often dictated by the task and skills, and the methodology used to capture them. In the following, we elaborate on the core of the Virtual Job Taste methodology which largely defines how tasks in the vocational domains are captured for the purpose of designing authentic VR experiences.

Capturing task and skills

The objective of Virtual Job Taste is to provide authentic experience of the domain. This means capturing an authentic representation of tasks and skills required to accomplish them. Therefore, to capture the essence of the commonly performed tasks in the domain and the skills commonly required to thrive in the domain, the methodology focuses on the identification and capture of *Representative tasks* (RTs) of the domain. RTs capture the essence of "expert's" performance in a specific domain and are used to study/measure expertise in a particular domain in a laboratory setting. Experts often are touted to have 10,000 hours of experience within a particular domain and are the ideal encapsulation of

[31] Bibeg Limbu, Mikhail Fominykh, Roland Klemke, Marcus Specht and Fridolin Wild (2018) Supporting Training of Expertise with Wearable Technologies: The WEKIT Reference Framework http://doi.org/10.1007/978-981-10-6144-8_10

skills required to succeed in the domain. RTs are identified or designed to simulate task demands and situations that occur on a regular basis. This includes capturing, often in a simulated in situ lab setting, the core interactions of the expert with the environment that led to the desired performance outcomes. RTs are created/designed such that the task constraints/requirements and the performance outcomes are generalizable in the domain. Collections of RTs can not only be used to measure the objective performance of individual experts, but they can also be used for training new recruits as well as for maintenance, testing, and continued training of experienced professionals. Thus, arguably, RTs provide a glimpse of the structure of the domain itself and the skills an individual in the domain must learn to be regarded as an expert in the domain.

In well studied domains such as sports (chess, running) etc. RTs are established. However, RTs do not exist for all domains. Furthermore, it can be challenging to design RTs in unstructured domains. While systematic and generic methods to design RTs are lacking, the commonly used method is by identifying and systematically observing an expert in the domain. Ideally, this should be based on objective performance ratings such as Elo rating in chess, however, in cases where such objective measures do not exist, simply, the experience of the person or social acceptance may also suffice. Once the best performers are identified, process tracing methods, such as eye tracking, ethnography, task-analysis, think-aloud etc. can be used to capture their expertise in RTs. Underpinning mechanisms behind the expert performance, which requires another expert, allows trimming away irrelevant aspects from the task, paving the way for generating the skills required to complete RT, and often their objective measure as well. With the workspace, tasks, and skills of the domain captured, the following section illustrates the process of designing the Virtual Job Taste.

3.2 Virtual Job Taste

How to provide young job seekers with sufficient exposure to get an idea of professions with Virtual Reality?

Virtual Job Taste is an interactive simulation of a workplace and typical work tasks, i.e., representative tasks, with the use of VR technology and game elements, which aims to provide an insight into different vocational professions in a safe and engaging way, instead of simply presenting information about professions, allowing the user to experience them directly[32]. Such experiences can be presented in the form of *virtual internships* which are structured towards the goals and needs of individual job seekers who are already familiar within the domain.

The Virtual Job Taste experience is unique in that it provides a glimpse at or a 'taste' of a particular profession without necessarily covering all the details. Such experience aims to simply provide sufficient exposure to the young job seekers to get an idea of the domain rather than to train them. VR allows the users to experience unfamiliar situations in a safe

[32] Mikhail Fominykh, Ekaterina Prasolova-Førland (2019) Immersive Job Taste: a Concept of Demonstrating Workplaces with Virtual Reality https://doi.org/10.1109/VR.2019.8798179

context and thus be better prepared for them, with the goal of mastering the transition to work or to vocational education.

It is important to note that Virtual Job Taste is different from typical workplace training. Although the Virtual Job Taste can help to become familiar with workplace tasks and situations, the goal is not to practice work tasks in a profession, but rather to explore and learn how it feels to perform such tasks.

Virtual Job Taste aims to provide a neutral but engaging experience of being a trainee at a workplace. It is important to promote the profession carefully not to create inflated expectations. The VR experience should be authentic but non-judgmental. Virtual Job Taste aims to develop interest in the users and invoke their intrinsic motivation.

Who can benefit from Virtual Reality apps designed according to Virtual Job Taste?

The Virtual Job Taste concept is developed to provide a rich and interactive representation of workplaces and professions, targeting two groups:

- *Young job seekers*, including school pupils and young unemployed. We aim to help young job seekers gain insight into different workplaces. The VR experience should improve the understanding, attitude and perception of work and work-life among the young job seekers, consequently leading to the development of the four career development skills (DOTS).
- *Vocational education applicants and students*. We aim to help vocational education applicants and students get insight into the professions relevant for their interest and/or study program. The VR experience should deepen their understanding of the profession and link theory to practice and culture.

Virtual Job Taste assumes that the VR applications are integrated into the wider career counselling and vocational education, targeting the trainers:

- *Career counselors* can use the VR application as one of the tools in their counseling toolbox to assist job seekers in choosing the suitable vocational educational course for their future careers of interest.
- *Vocational trainers* can also use the VR application as an introductory/orientation strategy to get new students engaged in the domain while imparting foundational knowledge for more complex skills learning.

3.3 Integrating VR experience into career guidance practices and vocational training

How to integrate Virtual Reality apps designed according to Virtual Job Taste in career guidance practice?

In this section, we describe how VR experience can be interpreted in traditional processes and practice in career guidance and VET. It is often difficult for organizations to start using new technologies, and therefore it is important to provide a guide or methodology of how different technologies can be used so that they are effective.

The role of a counsellor in career counselling is elaborated by the 4C's model which emphasises the need for a counsellor to actively listen to the students. To do so the counsellor must first make a *Contact* with the students in a pleasant and respectful manner to build trust and relationship. The counsellor can achieve this by pre-setting goals for the conversation to manage expectations and listening to the students actively. Secondly the counsellor forms a *Contract* with the student where he/she sets a common focus which can be re/negotiated by creating an understanding. Once the contract is formed, the counsellor needs to *Communicate* their reflection on the problem of the students and their intentions of action clearly. The counsellor can achieve this by using metacommunication to show presence, personality and by getting a good flow in the conversation. Finally, the counsellor *Concludes* or summarizes the possibilities for further process or action. The summary can provide answers to questions such as, does the job seeker have a plan for further progress or an understanding of what the next step is?

The Virtual Job Taste aims to support the aforementioned roles of the counsellor with a VR experience. In order to do so, the application of the VR experience in practice follows the four steps of Kolb's learning cycle[33].

The Kolb's Learning Cycle is a cyclic model of experiential learning often used in career counselling and focuses on career counselling in multiple iterative steps[34]. These steps are relevant in face-to-face counselling, to reflect over what has been done, what the job seekers have learned, reflect on their feelings toward these tasks, and then implement it in further use.

0. *Starting a conversation*: In the context of career counselling, starting a conversation is important and not always easy. Young job seekers resist conversations about jobs and study. Therefore, it is vital to break the ice before any meaningful interaction can be had, or before the job seeker can engage in the four stages of Kolb's learning cycle. The VR experience acts as a tool to facilitate this while also potentially catching the curiosity and interest of the young job seekers which can greatly increase their engagement in the upcoming experiences.
1. *Concrete experience*: With VR, young job seekers can get an authentic experience of the job tasks. In contrast to passive involvement, such as by observation or reading, VR enables the users to be actively involved and engaged in the experience.
2. *Reflective observation*: At this stage in the cycle, the young job seekers have the opportunity to ask questions and discuss the experience with the counsellor. This stage can overlap with the concrete experience If the necessary reflection is implemented in VR or if the career counsellor can be a part of the VR multi-user experience. This allows the counsellor to mould their thoughts and also allows the young job seeker to get immediate feedback on their questions which allows them to identify any discrepancies between their understanding and the experience itself.

[33] Ronald R. Sims (1983) Kolb's Experiential Learning Theory: A Framework for Assessing Person-Job Interaction https://doi.org/10.5465/amr.1983.4284610

[34] George Atkinson Jr. and Patricia H. Murrell (1988) Kolb's Experiential Learning Theory: A Meta-Model for Career Exploration https://doi.org/10.1002/j.1556-6676.1988.tb00890.x

3. *Abstract conceptualization*: Following the reflective observation, the young job seeker attempts to draw conclusions of the experience by reflecting on their prior knowledge. VR can support this in the form of summative assessment, analytics and recorded observations to foster deeper reflection, and hence more concrete conceptualization of the experience.
4. *Active experimentation*: At this stage, the young job seeker can test their understanding in a new context. Often in traditional settings this would be difficult to achieve, but VR provides opportunities to revisit the experience, often with added novelty in each repetition. Counselors can make use of such repetitions to assess the personality of the job seeker and model their motivation and interests to provide more helpful and personalized suggestions.

Following the VR session, the young job seekers get to know the basic "language" the occupations are trying to share. In addition, the VR applications will enable, both people with or without knowledge, to get an introduction, and test tasks which will grant them knowledge about the profession and industry, their self-efficacy towards similar tasks in the future, and their motivation. The counselor's role here would be to make structure of these experiences they have had during the VR encounter, reflect, and show the opportunities towards the profession.

4. Virtual Job Taste: Design Methodology

How to design a Virtual Reality application according to the Virtual Job taste concept?

The Virtual Job Taste concept has been extended to a design methodology for developing VR applications for different workplaces and professions. The methodology was derived from the development and evaluation processes in the Virtual Internship project[35,36],[37] .

The methodology is developed to:

- capture workplaces to convey work experiences, including physical places, human activity in representative tasks, and culture in the workplace
- create a scenario that should enrich the visit to a workplace with information and feedback
- deliver this to users through interactive VR experiences

In the sections below, we provide an overview of how the concept of Virtual Job Taste has been operationalised within a design methodology.

4.1 Overall approach

From a broad perspective, the Virtual Job Taste design methodology is inspired by Design Thinking, an iterative methodology that focuses on understanding the needs and desires of users to create innovative solutions[38].

The Virtual Job Taste design methodology uses the five phases of the Design Thinking methodology (See table below). The design methodology provides detailed guidelines for the first three phases, inspired by the Design Thinking methodology:

- Empathise, section 4.2
- Define, section 4.3
- Ideate, section 4.4

The activities of the Virtual Job Taste methodology are divided to the *Concept level* (those relevant to all professions) and the *Profession level* (different for each profession). The Table below maps these activities to the five phases of Design Thinking.

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[35] Virtuell praksisplass (2020) https://www.nav.no/no/nav-og-samfunn/kunnskap/forskningsrapporter-og-evalueringer-finansiert-av-nav/samhandling-med-brukere-rapportarkiv/virtuell-praksisplass

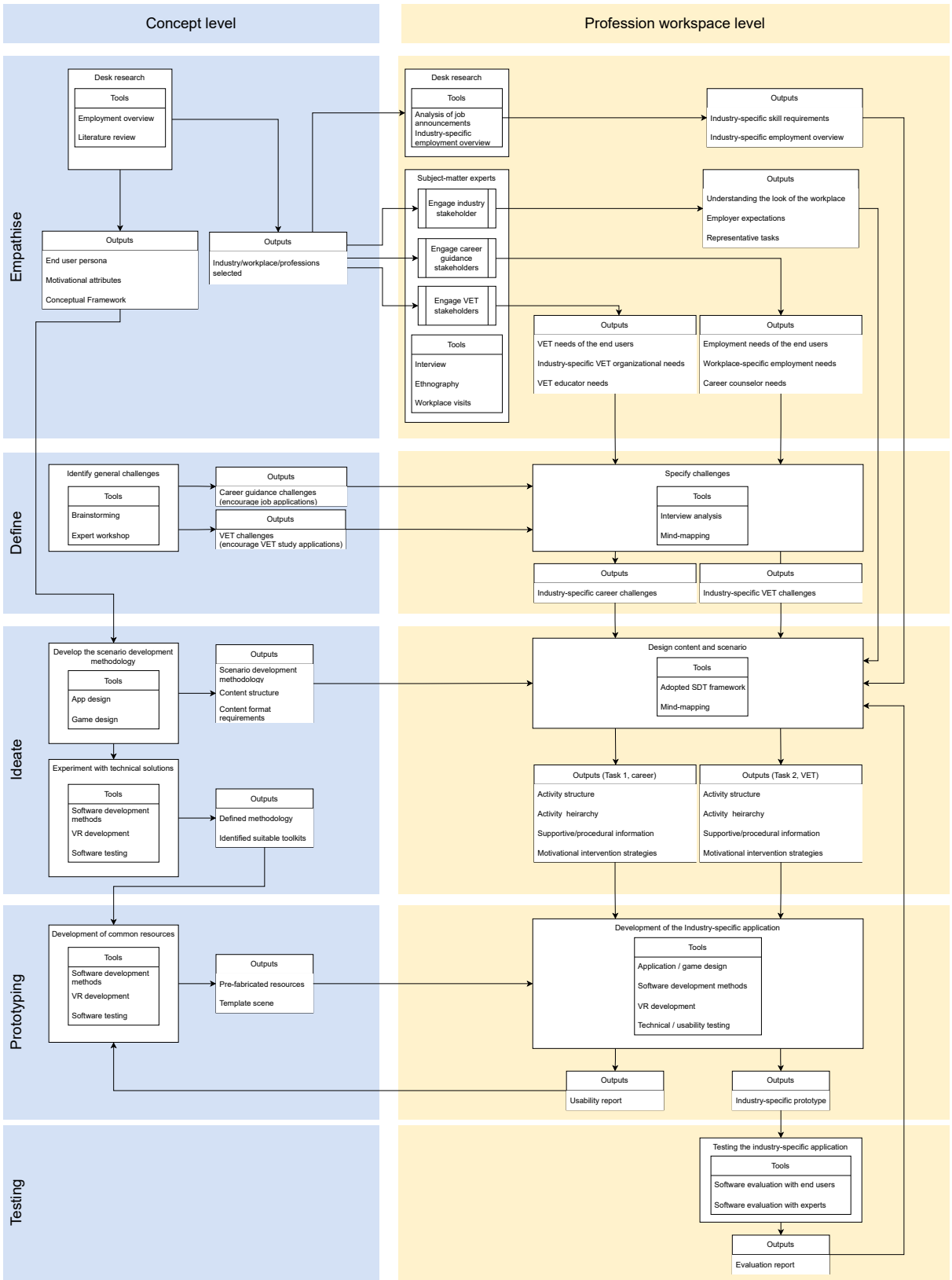
[36] Virtuelle praksisplasser VR/AR: videreføring og utprøving (2024) https://www.nav.no/no/nav-og-samfunn/kunnskap/forskningsrapporter-og-evalueringer-finansiert-av-nav/samhandling-med-brukere-rapportarkiv/virtuelle-praksisplasser-vr-ar-videreforing-og-utproving

[37] Ekaterina Prasolova-Førland, Mikhail Fominykh and Oskar Ekelund (2019) Empowering Young Job Seekers with Virtual Reality https://doi.org/10.1109/VR.2019.8798179

[38] Michael Lewrick, Patrick Link and Larry Leifer (2018) The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

Phase	Concept level	Profession level
Empathise	• Desk research on career guidance and vocational education • Employment overview • Literature review and background analysis	• Analysis of job announcements • Industry-specific employment overview • Interview stakeholders (employers, career counselors, VET trainers) • Definition of skills • Definition of end-user and stakeholders' needs • Visiting workplaces • Defining representative tasks
Define	• Defining common challenges for career guidance and VET	• Defining industry-specific challenges for career guidance and VET
Ideate	• Develop scenario development methodology • Experiment with technical solutions • Define requirements	• Design content and scenario (including activity structure, hierarchy, supportive or procedural information, and motivational intervention strategies) • Develop low-fidelity prototypes
Prototype [*Outside the context of this document*]	• Develop common resources and assets	• Develop industry-specific applications and test usability
Test [*Outside the context of this document*]	• Test common resources and assets	• Test and evaluate industry-specific applications

In more detail, the overall approach is presented below. It also shows the concept level on the left and the profession level on the right.


Concept level
Profession workspace level
Empathise
Desk research
Tools
Employment overview
Literature review
Outputs
End user persona
Motivational attributes
Conceptual Framework
Outputs
Industry/workplace/professions selected
Desk research
Tools
Analysis of job announcements
Industry-specific employment overview
Outputs
Industry-specific skill requirements
Industry-specific employment overview
Subject-matter experts
Engage industry stakeholder
Engage career guidance stakeholders
Engage VET stakeholders
Tools
Interview
Ethnography
Workplace visits
Outputs
Understanding the look of the workplace
Employer expectations
Representative tasks
Outputs
VET needs of the end users
Industry-specific VET organizational needs
VET educator needs
Outputs
Employment needs of the end users
Workplace-specific employment needs
Career counselor needs
Define
Identify general challenges
Tools
Brainstorming
Expert workshop
Outputs
Career guidance challenges (encourage job applications)
Outputs
VET challenges (encourage VET study applications)
Specify challenges
Tools
Interview analysis
Mind-mapping
Outputs
Industry-specific career challenges
Outputs
Industry-specific VET challenges
Ideate
Develop the scenario development methodology
Tools
App design
Game design
Outputs
Scenario development methodology
Content structure
Content format requirements
Experiment with technical solutions
Tools
Software development methods
VR development
Software testing
Outputs
Defined methodology
Identified suitable toolkits
Design content and scenario
Tools
Adopted SDT framework
Mind-mapping
Outputs (Task 1, career)
Activity structure
Activity heirarchy
Supportive/procedural information
Motivational intervention strategies
Outputs (Task 2, VET)
Activity structure
Activity heirarchy
Supportive/procedural information
Motivational intervention strategies
Prototyping
Development of common resources
Tools
Software development methods
VR development
Software testing
Outputs
Pre-fabricated resources
Template scene
Development of the Industry-specific application
Tools
Application / game design
Software development methods
VR development
Technical / usability testing
Outputs
Usability report
Outputs
Industry-specific prototype
Testing
Testing the industry-specific application
Tools
Software evaluation with end users
Software evaluation with experts
Outputs
Evaluation report

4.2 Empathize

In the Empathise phase, the objective is to understand the problem, the users and their needs, and challenges. This phase is largely characterized by engaging in user-centered research and conducting interviews, observations, and surveys with the target audience to gain insights and develop empathy for the users, to gather information that will inform the design process. As part of this phase, the team of VR developers, designers, and scenario developers should visit the target workplace and be guided through the typical tasks. A good approach is to record the experts performing tasks or teaching someone (e.g., trainees).

The Virtual Job Taste methodology does not define strict steps in this phase for professional workspace, as the key to a good task analysis is the selection of the right tool for the specific context. Therefore, for each profession and industry where the methodology is applied, the Empathise activities should be conducted in their own accord.

4.3 Define

In this phase, the research findings are synthesized to define a clear problem statement, requirements, and challenges to guide the design process. By mapping users' needs on the conceptual level, the Virtual Job Taste methodology suggests several challenges that young job seekers have and possible solutions that are worth exploring. The methodology highlights differences in what young job seekers and career counselors see as the reasons for these challenges. The most important challenges include:

- Challenges of completing the internship period, job interview and dealing with situations that may arise daily in the workplace
- Existing job descriptions are often text-heavy and gave little insight into the profession itself

The most requested features in the applications were:

- Job interview simulation
- Visualization of actual jobs

In addition, users wanted to be able to link the information about the professions to the actual jobs (transfer of learning), tasks and skills required. The young job seekers wanted to get feedback on their actions to build trust and a sense of mastery.

Based on the data synthesized from users' needs, we defined the four main components of the Virtual Job Taste Methodology:

- *Complex tasks*: specific description of the activities that entails working at the job
- *Key skills*: specific skills required to be successful and attain mastery in that job
- *Feedback and reflection*: instructions and assistance provided during the job

These components form the foundation of Virtual Job Taste experience. A profession can be presented with the help of a representative task which is composed of several simple (sub-)tasks and can normally be given to trainees and apprentices. These tasks are first

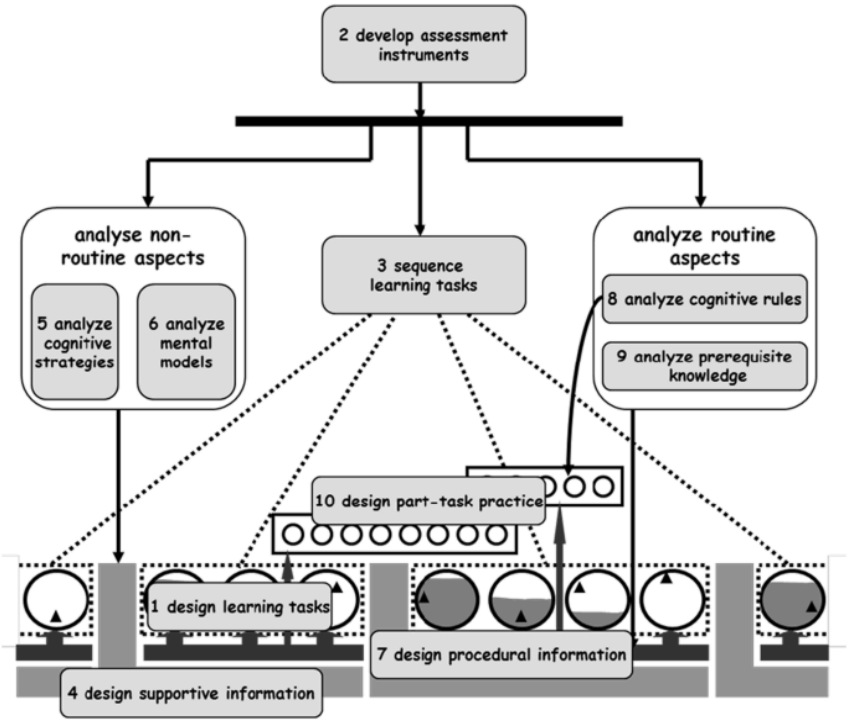
demonstrated to provide guidance and form a mental model of the key skills they need to learn. Then, the simulated job environments allow the users to observe how the tasks are done and then actively participate in the tasks themselves, while receiving feedback on their performance. The goal of such activity is to convey a sense of being at work (or job taste) and build self-confidence, rather than training on work assignments. Therefore, evaluation of the user's performance, which is represented by the progression system, must take the form of summative feedback to users on what was done right or wrong. This connects the tasks and key skills required to perform these tasks, and information about the workplace.

4.4 Ideate

In the Ideation phase, we brainstormed ideas and potential solutions to the problem with the requirements set in the define phase. At the conceptual level, scaffolds and guidelines were created to structure and communicate the ideation of domain specific use-case scenario applications while adhering to the unified vision and design language of Virtual Job Taste. These scaffolds can be viewed from the lens of three core concepts/requirements described in the Background section, namely Vocational Education (4C/ID), Career counseling (DOTS), and Motivation (Gamification).

Vocational education: Ten Steps to Complex Learning

This instructional model by Kirschner & Norman is an extension or operationalisation of the 4C/ID model with ten explicit instructions to structure the complex task by decomposing it into the four components of the 4C/ID model. The original model "Ten Steps to Complex Learning"[39] can be seen on the figure below.



[39] Paul A. Kirschner & Don Norman (2021) The Teaching and Learning of Design https://www.kirschnered.nl/2021/04/18/the-teaching-and-learning-of-design/

This aspect encompasses three of the core aspects of the VR4VET experience, i.e., *Complex tasks*, *Skills*, and *Feedback and reflection*. However, the "10 Steps to Complex Learning" model is specifically designed to teach complex skills (tasks here) in a holistic manner. Therefore, we adapted the model further to remove explicit focus on "mastering" the task and instead emphasized on experiencing the task in an authentic manner while catering all beginner's skill levels. For a quick overview of the steps we omitted from the "10 steps to complex learning" in the Virtual Job Taste design methodology, see the table below.

"Ten Steps to Complex Learning" model	**Adaptation to Virtual Job Taste**
1. Design learning tasks	1. Define workplace subtasks
2. Develop assessment instruments	2. Develop assessment instruments
3. Sequencing learning tasks	3. Sequencing the subtasks
4. Design supportive information	4. Design supportive information
5. Analyze cognitive strategies	Omitted
6. Analyze mental models	Omitted
7. Design Procedural information	7. Design Procedural information
8. Analyze cognitive rules	Omitted
9. Analyze prerequisite knowledge	Omitted
10. Design part-task practice	10. Design part-task practice

Complex tasks are characterised by many subtasks aimed at accomplishing the goal of the complex task. Each subtasks further constitutes a number of procedural steps that the learner needs to perform. Complex tasks require application of both cognitive and procedural skills and often have a loose hierarchy and dependency among those subtasks and the skill used in these subtasks.

In general, these subtasks can be categorised into two types based on their dominant skill type: (a) cognitive aspects that require thinking and decision making and (b) procedural aspects that need to be automated and require repetitive practice to automatize. This model assumes that a successful execution of a complex tasks relies on four basic components:

- *Learning tasks*: the goals of each of the subtasks that ultimately lead to the completion of the complex task
- *Supportive information*: information necessary to relate to the domain, often relevant for more cognitive aspects of the complex task
- *Procedural information*: instructions provided just in time at a step level, which are useful to perform the next step

- *Part-task practice*: activities in the context of subtasks which require repeated practice to perform better.

As stated earlier, the Virtual Job Taste methodology puts reduced emphasis on this aspect as mastery of the skill. In the following, we elaborate further on the changes made to each of the selected steps of the "10 Steps to Complex Learning" model to adapt it in the context of the Virtual Job Taste methodology.

Learning tasks

1. Defining subtasks
    a. Break down the complex task into subtasks
2. Develop assessment instruments
    a. Set performance objectives for each subtask.
    b. Define the conditions for a successful or unsuccessful completion of the subtask.
    c. Define which skills are required for and are developed by performing each subtask.
3. Sequence the subtasks
    a. Arrange the subtasks according to the increasing dependency (what needs to be done first) to determine the sequence (can have multiple paths with the same start and end).
    b. Rate each task according to its complexity and arrange them according to the increasing complexity where it is possible (where it does not interfere with the subtasks being done in reality).

Supportive information deals with cognitive aspects, problem solving and reasoning. Supportive information should connect the subtask to the whole "complex" task helping users to understand the bigger picture.

1. Design supportive information
    a. Supportive information for subtasks can include information such as why the subtask is relevant, what are things to look out for, and similar.
    b. Not all subtasks need to have supportive information. Supportive information should be faded out in the next repetition of the subtask.
2. [Omitted] Analyse cognitive strategies (of experts): This phase of the model is omitted from the adaptation, since our end users do not have any experience in the domain and since mastery of the task is not the goal.
3. [Omitted] Analyse mental models (of experts): This phase of the model is omitted from the adaptation, since our end users do not have any experience in the domain and since mastery of the task is not the goal.

Procedural information deals with steps of subtasks.

1. Design procedural information
    a. These are instructions that the learners need "just-in-time", right before executing a specific step of the subtasks, so that the learners can execute this

step. Such information can be given in a form of feedback when a step is not performed correctly and needs to be repeated.

2. [Omitted] Analyse cognitive rules (of expert): This phase of the model is omitted from the adaptation, since our end users do not have any experience in the domain and since mastery of the task is not the goal.
3. [Omitted] Analyse prerequisite knowledge (of expert): This phase of the model is omitted from the adaptation, since our end users do not have any experience in the domain and since mastery of the task is not the goal.

Part task practice deals with providing opportunities to repeatedly practice a task or a step to develop automaticity.

1. Design part task practice:
    a. Repetitive steps should be identified. It should be possible for the user to repeat (practice) such a step if he/she wishes or until a satisfactory performance level is met.

Tips:

(?) If we assume making a wooden chair as a complex task, example subtasks would be to be "making a leg" and "making a seat". The example steps of the "making a leg" subtask would be: "sawing a plank" (so that the legs could be made from it) and "cutting out holes in the planks" (so that they can be used for support).

(?) Procedural information is different from supportive information. Procedural information should enable the learner to successfully complete the subtask step by step and is provided just in time. Procedural information example: "Preheat the oven to 90 degrees" (Supportive information in this case would tell the user why it needs to be first preheated to 90 degrees).

Structure for the Tasks, Subtasks, and Steps

In the following sections, we provide a template based on the adapted model described above to help individual domains ideate solutions for their particular domains and communicate their solutions efficiently to the development team for the next phase, i.e. the prototyping. The content should be structured around the complex workplace tasks. The tasks consist of subtasks. The subtasks consist of steps. The components and concepts of the "10 steps of complex learning" model interact with the different levels of this task structure according to the table below.

Structure element	**Supportive information**	**Procedural information**	**Part task practice**	**Assessment**	**Sequencing**
"Complex" task	Must have			Must have	Can have
Subtask	Must have		Can have	Must have	Must have
Step		Can have	Can have		Can have

(Complex) Task

Structure: Tasks consist of subtasks. There must be more than one subtask in each task. The subtasks might need to be repeated one or multiple times. In case of multiple repetitions of the task, all subtasks (not just some of them) are repeated as many times as required. Below, we define a template for identifying and communicating a "basic task" class.

Basic Task class

- String task title
- String task description (aka supportive information)
- List of subtasks
- Integer number of task repetitions required [to complete the task]

Randomization in the tasks: The sequence of subtasks should not be randomized, but some parameters inside each subtask can be randomized.

Example of a Task identification

Task title	**Task description (supportive information)**	**List of subtasks**	**Repetitions**
Registering the package	The registering task aims to package sealed fish into boxes according to an order from a customer.	1. Prepare a box for registration 2. Visual inspection 3. Weight sealed package 4. Place sealed package in the box 5. Complete the box	1..N Can be randomized: 20<N<100

Subtasks

Subtasks are parts of the whole "complex" workplace tasks. Subtasks are independent collections of steps characterised by an identifiable sub-goal of the complex tasks. When they are put together and connected with other subtasks, they form the whole of the "complex" workplace tasks. In other words, in addition to being a part of the structure of the parent complex task, subtasks may also be related to other subtasks in the form of dependencies and the order in which they need to be executed. Describing them according to this model provides a structured approach to communicate the complex task, which makes it easier to understand and simulate these tasks in VR.

Structure: Subtask consists of steps. There might be between one and many steps in each subtask. If a subtask consists of only one step, it becomes equal to this step.

Basic Subtask class

- String subtask title
- String subtask description (aka supportive information)
- List of steps
- Integer number of subtask repetitions required [to complete the subtask]

Randomization: The sequence of steps should not be randomized, but some parameters inside each step can be randomized.

Example of subtasks

Subtask title	**Subtask description (supportive information)**	**List of steps**	**Repetitions**
Prepare a box for registration	The empty box needs to have a clean plastic sheet.	1. Take the box	1
Visual inspection	The aim of the inspection is to check that the automatic or manual packaging was done correctly.	1. Check vacuum 2. Check # of fish	1
Weight sealed package	The aim of weighting the sealed package is to check that the package is within the range specified in the customer order.	1. Put on the scale 2. Compare weight data	1
Place sealed package in the box	Multiple sealed packages are placed in each box. A correct number of packages should be placed.	1. Place the sealed package in the box 2. Count the packages in the box	1..N Can be randomized: 5<N<10
Complete the box	Labelling is done to identify the product in the box. The label needs to be checked if it is not damaged and that it displays correct information.	1. Print a label 2. Stick a label to the box 3. Send the box to delivery	1

Steps

Structure: Step is an atomic entity (does not consist of anything).

Basic Step class

- String step title
- String step description (aka procedural information or a hint)
- Integer number of step repetitions required [to complete the step]

Example

Step title	**Step description (procedural information)**	**Repetitions**
Take the box	The boxes are in “this area”. Clean plastic sheets are stored together with them.	1
Check vacuum	Check that the package is vacuumed, not air inside.	1
Check the number of fish in the package	The number of fish should correspond to the information in the customer order.	1
Put the package on the scale	The scale displays the weight on “this” screen.	1
Compare weight data	The required package weight is displayed in the customer order information “here” on this screen.	1
Place the sealed package in the box	The sealed boxes are placed in the box you prepared earlier.	1
Count the packages in the box	The number of sealed packages in the box should correspond to the customer order information “here” on this screen.	1
Print a label	Press “this” button to print the label.	1
Stick a label to the box	Stick the label on the side of the completed box.	1
Send the box to delivery	Move the completed box into "this area”	1

Virtual Job Taste template for describing a workplace task

Selecting the tasks should be done before filling in this template. The task should be representative of the profession and should be typical for trainees and apprentices. Each workplace task should be designed as presented in this section. The template helps to define the scenarios of the Virtual Job Taste experience.

Task

Workplace task title

The goal of the "complex" workplace task (Supportive information)
One sentence description. Example: packing fish is the process of manually pressing the automatically loaded fish into boxes so that the fish does not stick out.

Where is this task performed? In which specific area of the workspace?
Few sentences description of the workspace, so that it is possible to identify it in the footage collected during the visit to the workplace.

Break down the complex workplace task into separate subtasks.
List of subtasks in the most typical order of performance: - Step name - …

Subtask

For each subtask, define the following:

Subtask name

⬜ Mandatory subtask (completing all mandatory subtasks is required to complete the “complex” task)

Key workplace skills
List of workplace skills are used to perform this subtask.

Assessment instrument: Indicators for a successful completion of the subtask
What triggers the successful completion of this subtask?

Assessment instrument: Indicators for a completion of the subtask (imperfect, possibly with errors)
What triggers the completion of this subtask?

Assessment instrument: Indicators for failure(s)
What triggers a failure of this subtask? Not completing, forcing the user to re-do the subtask.

Assessment instrument: Indicators for errors(s)
What are the common errors when performing this subtask?

Sequencing: prerequisite completion
List of subtasks that must be completed (with success or failure) before the current subtask can be started.

Sequencing: prerequisite success
List of subtasks must be completed with success before the current subtask can be started.

Supportive information

Supportive information message
Describe why this subtask is done, why performing this subtask is important for the whole workplace task.

Cognitive strategy [optional, needed for cognitive tasks]
Describe how this subtask is done, how to approach the challenge, what factors to consider, how to take decisions.

Procedural information and part task practice

Describe how the step is done procedurally, especially if the step involves repetitive actions.

Step name (text)	**Procedural information (text)**	**Must be repetitively practiced**	**Indicators of automaticity**
Step 1 “name”	Instructions for performing the step	(Yes/No)	Performance level, practice time, number of runs, etc.
Step 2 “name”	Instructions for performing the step	(Yes/No)	
…			

Structure for the key workplace skills

The key skills for a particular profession are defined based on the typical job advertisements and conversations with employers to give the user a clearer picture of the profession and necessary skills. Job advertisements often contain a list of necessary or desired skills, but there is little information about what lies behind or what these skills mean in the profession.

- Key skills should be identified for each profession based on an analysis of job advertisements and further detailed with subject-matter experts.

- Employers are interviewed to gain a better understanding of typical work tasks and key skills needed to perform these tasks.

The skills should be integrated into the scenario in the following way. Every task, subtask, and step should have a connection to one or multiple skills that are required to perform them. Correctly completing a task, subtask, or step should advance the user on the progression scale towards a competence level of one or multiple skills.

Example skill table

Percentages in the table below show the progression towards each skill. Different tasks can contribute differently towards achieving the maximum skill level. Using the Progression game element, an achievement can be given to the user when he or she reaches the progress towards a skill of, for example, 75%.

	Skill 1	**Skill 2**	**Skill 3**
Task 1	20% (calculated)	30% (calculated)	
Subtask 1.1	10%	20%	
Subtask 1.2	10%	10%	
Task 2	80% (calculated)	70% (calculated)	100% (calculated)
Subtask 1.1	20%	30%	50%
Subtask 1.2	60%	40%	50%
…			

Structure for the feedback

The user receives different feedback based on how the tasks were completed. Formulations of feedback are prepared together with both employers and career counselors.

Immediate feedback

Immediate feedback should be given for each step the user performs in the Virtual Job Taste VR application. In most cases, this feedback should indicate if the user has completed a step (different for correctly and incorrectly completing it).

Performance summary

A summary of the user's performance should be available at any time when using the Virtual Job Taste VR application. The summary should provide the basic state of progressing through the VR application (which workplaces were visited, which tasks and subtasks have been completed, etc.). A basic summary can be presented through the Status game element.

The message in this summary should rely on the Supportive Information and Procedural Information formulated for each task. This summary aims to help the user's to better understand the typical tasks of the profession by connecting by providing feedback on their concrete performance in the VR application.

Progression summary

A summary of the user's achievements towards the skills should also be available at any time when using the Virtual Job Taste VR application. The summary should provide the progress towards the key skills and the list of achievements. A basic summary can be presented through the Status game element.

The message in this summary should rely on the information on the key skills obtained from the interviews with subject-matter experts and industry stakeholders. This summary aims to deepen the user's understanding of the key skills required in a particular industry through connecting their descriptions to the concrete results of the user's achievements and performance in the VR application.

Summative feedback and reflection

Using both performance and progression summaries, a summative feedback message should be composed for the user. This summative feedback should be delivered to the user as an input to the Reflective observation phase, according to Kolb's Learning Cycle approach. This summary can also be presented as part of the narrative and delivered via an NPC.

The feedback should be positive and reassuring. For example, if the user completed a specific task that required the skills of being organized, the feedback should include the right keyword, e.g. "You are organized".

The summative feedback should be connected or presented together with reflection. The user should be asked reflective questions, structured along the career development skills (DOTS). These questions can be asked inside the Virtual Job Taste VR application (e.g. by an NPC) or by a human counsellor after the VR session.

It is important to let the user hear the questions and think about them even if a counsellor is not available for a conversation after the VR experience. It is also possible to train a Large Language Model to conduct such a conversation instead of a human counsellor.

Gamification of Virtual Job Taste

Our objective for using gamification or game elements as part of Virtual Job Taste design are:

1. To increase motivation among users/players to complete the application or even continue beyond the VR experience.
2. Foster tangential learning which can develop intrinsic interest in the players/users.

In the context of the Virtual Job Taste, we operationalize gamification Self-Determination Theory (SDT). While both theories SDT and EVT (see the Background section) provide valid approaches to understand motivation in games and therefore act as frameworks for

gamification, SDT has a much larger body of frameworks and research in the context of gamification. One other consideration that the Virtual Job Taste methodology takes is that the selected gamification approaches must be suitable to any profession and industry domains represented in the VR experiences. Therefore, we have cautiously selected only those elements that are potentially interchangeable across many application domains and also focused on interlinking aspects of human-human counselling to the aspects of SDT theory.

Individual game elements and game design patterns proposed for the Virtual Job Taste design are detailed below. We use the term game elements loosely. Instead of strictly using game "elements" as defined or listed in other literature, we map any design elements of the Virtual Job Taste gamified experience to the SDT components. Furthermore, we make direct connections with Counsellors in instances where they directly affect a certain element.

By game design patterns, we understand “semi formal interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay”[40]. These elements are prone to interact one with the other in the user experience depending on their conceived usage in each particular VR application.

Game world

Game worlds provide players with an alternate reality, strengthening immersion through spatial engagement, particularly evident in games featuring first-person perspectives. These virtual environments restrict the player's focus area and often intuitively limit possible movement actions, establishing a foundation for a coherent logic within the scenario.

With Virtual Job Taste, we aim to provide the users with sufficient coherence to give a sensation of realism. For this reason, a structural element of the gamification of the workspace is a 3D virtual space that represents a typical workplace where the activities associated with the work tasks should be performed. This world needs to be tightly connected to the narrative, and, with different spatial elements, we open the possibility to modulate the progression of the player through it.

One of such subelements is the potential utilization of inaccessible areas that can become accessible by solving subgoals, serving as traverse goals. Utilizing such areas strategically can help construct the game's narrative structure, particularly when obstacles hint at the potential for later access, motivating players to progress. This also might help support the fact that the experiences incorporate a smooth learning curve and thus guide the experience step by step.

Narrative

Each experience should lead the player through an even progression in a planned narrative, featuring defined goals structured as tasks, subtasks, and steps. For each one of these, it is important to keep the “illusion” of achievement in the experience to enhance the player engagement, through the completion of narrative milestones specific to each scenario. The

[40] Staffan Björk and Jussi Holopainen (2005) Patterns in Game Design

content is highly subjective to each work experience, but it is intended to follow the acquisition of the career development skills and learning about the specific profession.

Optimal challenges

Several work tasks should be simulated in the VR application. In the selection of tasks, those usually performed by an apprentice, or a trainee should be prioritized. The tasks should also be representative of the profession and consist of daily tasks undertaken by employees. Information about the work tasks should be gathered from interviews with employers and other sources.

Since the target users of the Virtual Job Taste applications are generally unfamiliar to the domains, the VR experience must implement instructional strategies such as scaffolding to compensate for the lack of prerequisite knowledge. This is vital to fostering competence in potential employees. In the scaffolding process, a "Complex" task is broken down into steps. Steps are defined as distinct activities or actions that need to be undertaken to achieve the goal of the task, and any "complex" task must contain multiple of such activities. The steps must be guided in a timely manner in the VR environment in a sequential order of execution while prioritizing the dependency i.e., if a step depends on the result of other independent steps, such seps must be executed at the later order. It should also be possible to redo the mistakes/errors occurred when performing steps.

Status

Game status is necessary to keep the player informed about the progression through the scenario and content of the Virtual Job Taste application. The status is an essential point of reference for the player to evaluate his or her current state of completion of the available tasks. The status can be delivered, for example, though a virtual tablet.

Levels

Two difficulty levels should be introduced in the Virtual Job Taste VR experience. The first level should work for the introduction of the profession and the workplace, primarily targeting the young job seekers. The second level should include more details, more “Create”- Bloom taxonomy tasks, and more training elements. The second type of levels can be unlocked by completing the first type of levels.

Non-player characters

Non-player characters (NPCs) serve multiple roles as supervisors, social pedagogs, and co-workers. Supervisor NPCs are meant to provide feedback that steers the player to the completion of the complex workplace tasks. These NPCs are meant to be a critical part of the narrative, in such a way that with their dialogue lines achieve and modulate an emotional response in the player, that maintains a constant level of motivation. Social pedagog NPCs aim to accompany the users through the VR experience. Co-worker NPCs should help the user to have an overview of how many people work in a specific workplace, what they do, etc.

NPCs could support the players by answering relevant questions in a form of a free dialog, supported by Large Language Models.

Tools

Depending on the specific Virtual Job Taste experience and scenario content requirements, the players are likely to require tools, which is a particularly advantageous aspect in VR where players can engage in more haptic interactions with virtual objects. These can also help to achieve a higher level of immersion and consistency in the experience. Concurrently, these tools can serve to unlock further the narrative presented to the user used in interaction with the game world, if connected to an adequate narrative.

Clues or hints

To aid in the accomplishment of particular tasks, and however, as a non haptic extension of the narrative, we suggest incorporating specific elements that provide visual or auditory cues to the player if these are seen as essential for the content. Although it may mean a small sacrifice in terms of consistency in reality, it provides new players with a quick guide on how to proceed, when the narrative is not sufficient.

Progression

The progression is suggested as a soft reward element, as opposite to the score, points or leader boards. Correctly performing or completing specific tasks, subtasks, or steps of the Virtual Job Taste applications should lead towards unlocking achievements that represent the core profession skills.

Unlocking achievements and learning about the skills can be seen as a means to provide motivation to the players by the possibility of developing their own virtual character and reflecting on how this translates to the real skills.

5. Integration of Virtual Job Taste to Career Counseling and Vocational Training

5.1 Connecting Virtual Job Taste to the local work life

What career orientation information can be delivered through Virtual Job Taste?

VR applications developed for career guidance and vocational education following the Virtual Job Taste methodology should have a connection to the local work life to make them more relevant to the target users. Such a connection should make the information and impressions obtained in the VR experience actionable and directly applicable for the users.

In addition to the key information about the workplace tasks and required key skills, the scenario of the Virtual Job Taste application should present an industry represented in a VR application with information that is normally given in the career guidance.

General information about the industry stable across countries and regions:

- Typical values, culture, and work atmosphere / environment in the industry
- Overview of educational backgrounds that others in such a workplace have (role understanding)
- What and how extensive responsibility one has in different jobs in the industry profession
- Future prospects within the chosen industry or profession, with special emphasis on green transition and climate change

General information about the industry specific for countries and regions:

- Educational requirements for specific jobs in the industry
- In-demand certifications and courses
- Factors that the salary depends on / typical salary variables within the industry, for example, other benefits, bonuses, compensation, supplements, and pension schemes
- Working hours in the industry (and specific professions), for example, flexible time, shifts, evenings/weekends, and so on (also, how these affect salary)
- Normally available apprenticeships
- Legal regulations and other frameworks that affect the industry's operations, which the industry must comply with

Dynamic information about the industry specific for countries and regions:

- Average salary / impression of salary
- Worker demand trends in the industry
- Geographical growth or reduction in the industry
- Availability of internships
- Concrete organizations that offer apprenticeships in the subject
- Currently available apprenticeships
- Development opportunities in the industry

- Opportunities for further education

Concrete information about local industry:

- General access to the workplace, required commuting
- Housing opportunities in the local area

In addition, the information about the typical working day, typical workplace tasks, and the key competencies (and personal characteristics) can be presented by multiple means to further highlight who the job is best suitable for. In some industries and professions, relationships (e.g., between co-workers) are more important than the typical tasks. This makes the presentation of the workplace more complex, but could also be part of the Virtual Job Taste.

5.2 Integrating Virtual Job Taste practice

How can a VR experience be integrated into systematic career counseling and vocational education?

Virtual Job Taste integration in school visits to vocational education centers

Virtual Job Taste can be used as part of an organized visit to a VET center by a secondary school class, as part of job orientation or as a school to vocational education transition. Entire school classes being brought in touch with Virtual Job Taste VR experience as part of their visit to a VET-centre. The Virtual Job Taste VR experience can give the pupils practical insights into different jobs, guided by social pedagogs during their stay in a VET-centre. These pupils - being about to choose their future jobs – can then apply the VR experience to any workplace in the VET-centre.

Taking as an example one full day visit to a VET center, by a school class, the morning can be filled with some theoretical job information. It can be supplemented with some general info about VR and what is planned for the Virtual Job Taste should be delivered by training staff in order to raise curiosity on the pupils' side. Some opinions and prior experience of pupils´ VR-experience in general can be discussed. It is expected that VR will be known for gaming and leisure purposes if at all.

The second part will happen at a workshop place, where usually the classical training and job orientation take place. Part of the group can practice as usual, while a fraction of pupils can experience VR, considering the number of available devices and skilled personnel to assist. Pupils gathered in small groups to experience Virtual Job Taste VR apps provide an opportunity to try VR first and exchange among each other afterwards. Having done both classical job orientation and Virtual Job Taste, at the end of the day, this leaves the opportunity to reflect and compare both methods.

The VR experience should be holistic and uninterrupted. Once the users put on the VR glasses, they should not take them off again to talk to the counselor. So, if the VR experience is meant for a single user, the counseling should start before it and resume after the job seeker takes off the VR glasses. If the VR experience is multi-user (and the counselor

can be together with the job seeker in the same VR space at the same time), the counseling could also continue during the VR session.

Technical assistance should ideally be present prior and during the VR experience in order to lower drop out rate. Teaching staff has to be familiar with the Virtual Job Taste VR applications, be a confident user of VR technology, and the pedagogy behind the approach. Career guidance counselors, social pedagogs and technical vocational trainers have to be trained or train themselves in the use of Virtual Job Tastes VR applications hands-on with VR devices to be able to assist and support pupils as users.

Virtual Job Taste integration in vocational schools as preparation for internships

A typical use of a Virtual Job Taste in vocational education is bringing a practical situation into the classroom with VR glasses. Vocational students experience quite a gap between lessons at school and practice. They often find the courses too theoretically driven, and therefore experience a lot of tension when they do an internship. With Virtual Job Taste, we can narrow this gap and ensure that they feel less stress and are better prepared.

In preparation for the internship or an apprenticeship period, students can be prepared for the industry workplace with VR. In one half-day session at school, they can experience what a typical workplace looks like. They can explore the environment and perform typical tasks. After gaining this experience in VR, they can discuss with the teacher. The discussion can cover the details of the workplace that the students noted in the Virtual Job Taste app, content-related or professional attitude-related. They can discuss the knowledge and skills they still need to develop and the connection to the theoretical information they had from before.

An apprenticeship is usually a long-term training program to learn about a profession, while receiving compensation. In the company, apprentices get both training and practice in a subject. At the beginning of the apprenticeship, most of the time is spent on training, but gradually you participate in the regular tasks at the workplace. Apprentices have the same rights and duties as other employees in the company, but you are also entitled to training according to the curriculum in the subject.

An internship is usually a short-term work experience to learn about a profession and gain practical experience, while receiving or not receiving compensation. Internships are often offered to vocational students or recent graduates. In some vocational study programs, internships are required for receiving a degree.