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# Development of scenarios for Virtual Reality applications for Vocational Education and career guidance

# Workshop

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**Workshop**

Development of scenarios for Virtual Reality applications for Vocational Education and career guidance

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## Summary

This document provides a blueprint for a workshop on designing scenarios and content for vocational education and/or career guidance Virtual Reality applications. The workshop is replying on the VR4VET design methodology, which describes how the scenarios and content should be created for Virtual Reality applications to be used in career guidance and vocational education. The VR4VET methodology is inspired by the Design Thinking methodology, so the workshop makes an introduction to this methodology as well.

## Learning objectives

- Be familiar with scenario and content development for Virtual Reality applications
- Be familiar with the Design Thinking methodology
- Be familiar with the VR4VET methodology for scenario design
- Gain practical experience in designing scenarios for vocational education and/or career guidance Virtual Reality applications

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# Introduction

This document describes a workshop that guides professionals in designing scenarios and content for Virtual Reality (VR) applications to be used in career guidance and vocational education. The workshop relies on the Virtual Job Taste Design Methodology[1], derived from the theory and practice of career guidance and vocational education and developed in the VR4VET project. 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.

This workshop 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

# Background

## The Four Component Instructional Design Model

[1] Mikhail Fominykh, Bibeg Hang Limbu, Hannah Svennungsen, Carlos Andres Giraldo, Ekaterina Prasolova-Førland, Christian Lian Rasmussen, Nikolai Lykke Strand, Frank Bertelmann-Angenendt, Angela Friesen, Heidi Fossen, Arild Hegge Kristensen, Khaleel Asyraaf Mat Sanusi, Guido van Dijk, Leonie van Haren, Roland Klemke and Marcus Specht: Design Methodology for Virtual Reality in Career Guidance and Vocational Education (2025). VR4VET Consortium. https://www.vr4vet.eu/. DOI: 10.13140/RG.2.2.18677.28647.

One of the most prevalent instructional design models for training complex skills is the Four Components Instructional Design Model (4C/ID)[2]. 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[3]. 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 training, astronaut training, and engineering[4]. It has also been used with VR in the context of vocational training for vehicle painting[5].

The basic assumption of the 4C/ID is that complex skills learning can be described in terms of four components[6], 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.

## Design Thinking

Design Thinking is a human-centered, iterative approach to problem-solving that emphasizes empathy, creativity, and experimentation. It is widely used to tackle complex, ill-defined challenges—often referred to as "wicked problems"—by focusing on the needs and experiences of people rather than starting from technical constraints or preconceived solutions. At its core, Design Thinking combines analytical and creative methods to generate innovative solutions that are desirable, feasible, and viable.

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[2] 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

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

[4] 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

[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] 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

The process typically involves five stages: Empathize, Define, Ideate, Prototype, and Test. These stages are not strictly linear; teams often iterate between them as new insights emerge[7]. Empathy is foundational—designers seek to deeply understand users' behaviors, motivations, and pain points before defining the problem. Ideation encourages divergent thinking to explore multiple possibilities, while prototyping and testing allow rapid validation and refinement of ideas.

The concept gained prominence through the work of IDEO and Tim Brown, who described Design Thinking as "a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" (Brown, 2009)[8].

Today, Design Thinking is applied across industries, from product development to organizational strategy, because it fosters collaboration, reduces innovation risk, and ensures solutions resonate with real user needs. Its adaptability and emphasis on learning through iteration make it a powerful methodology for navigating uncertainty and driving meaningful innovation.

## 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"[9].

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.

| **"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] https://www.interaction-design.org/
[8] https://designthinking.ideo.com/
[9] 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/

| | |
|---|---|
| 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.

# Virtual Job Taste: Design Methodology

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[10,11],[12] .

The methodology is developed to:

- capture workplaces to convey work experiences, including physical places, human activity in representative tasks, and culture in the workplace

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

[11] 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

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

- 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.

## 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[13].

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, Define, and Ideate.

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. For more details see the Virtual Job Taste design methodology[14].

| **Phase** | **Concept level** | **Profession level** |
|---|---|---|
| Empathise | • Desk research on career guidance and vocational education<br>• Employment overview<br>• Literature review and background analysis | • Analysis of job announcements<br>• Industry-specific employment overview<br>• Interview stakeholders (employers, career counselors, VET trainers)<br>• Definition of skills<br>• Definition of end-user and stakeholders' needs<br>• Visiting workplaces<br>• Defining representative tasks |
| Define | • Defining common challenges for career guidance and VET | • Defining industry-specific challenges for career guidance and VET |

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

[14] Mikhail Fominykh, Bibeg Hang Limbu, Hannah Svennungsen, Carlos Andres Giraldo, Ekaterina Prasolova-Førland, Christian Lian Rasmussen, Nikolai Lykke Strand, Frank Bertelmann-Angenendt, Angela Friesen, Heidi Fossen, Arild Hegge Kristensen, Khaleel Asyraaf Mat Sanusi, Guido van Dijk, Leonie van Haren, Roland Klemke and Marcus Specht: Design Methodology for Virtual Reality in Career Guidance and Vocational Education (2025). VR4VET Consortium. https://www.vr4vet.eu/. DOI: 10.13140/RG.2.2.18677.28647.

| | | |
|---|---|---|
| Ideate | • Develop scenario development methodology<br>• Experiment with technical solutions<br>• Define requirements | • Design content and scenario (including activity structure, hierarchy, supportive or procedural information, and motivational intervention strategies)<br>• Develop low-fidelity prototypes |
| Prototype [*Outside the context*] | • Develop common resources and assets | • Develop industry-specific applications and test usability |
| Test [*Outside the context*] | • Test common resources and assets | • Test and evaluate industry-specific applications |

# Workshop structure and process

## Activity 1: Form working groups

Form groups of participants according to their field of work, consider their knowledge levels and expertise domain. Each group should ideally have at least one expert in teaching/counseling either vocational education or career guidance, one expert in a specific profession or industry sector, and one expert in VR technology or content design.

Define the goal of the tutorial for the participants and explain what the participants will learn or be able to do after the workshop.

## Activity 2: Empathize

In the Empathise phase, the objective is to understand the situation, 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.

At the workshop, we can start by defining the target group of the scenario - who will be the end users of the developed scenario, defining the profession or a training context. Next, the group members in each

group select one person who represents the targeted profession or context and interview this person, writing down notes.

## Activity 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.

## Activity 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[15].

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 selected steps of the "10 Steps to Complex Learning" model and the activities proposed to organize in the workshop.

*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.

*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.

[15] Mikhail Fominykh, Bibeg Hang Limbu, Hannah Svennungsen, Carlos Andres Giraldo, Ekaterina Prasolova-Førland, Christian Lian Rasmussen, Nikolai Lykke Strand, Frank Bertelmann-Angenendt, Angela Friesen, Heidi Fossen, Arild Hegge Kristensen, Khaleel Asyraaf Mat Sanusi, Guido van Dijk, Leonie van Haren, Roland Klemke and Marcus Specht: Design Methodology for Virtual Reality in Career Guidance and Vocational Education (2025). VR4VET Consortium. https://www.vr4vet.eu/. DOI: 10.13140/RG.2.2.18677.28647.

*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.

## Activity 5: Summary

The final activity of the workshop includes groups sharing the results of their work between each other and with the workshop organizers, discussing and providing feedback.