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eXtended Reality as Training Tool for Procedural Training: Learnings from the User-Centred-Design Process and the Implementation of Two Use Cases

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Abstract. Mindconsole GmbH has engaged with two customers in the development of two use cases regarding procedural training. Within the associated design process a number of stakeholder meetings has taken place were requirements and training goals have been defined and stakeholder roles identified. In addition, the detailed course of the procedures, the potential errors and distractions that can appear have been recorded. Based on these different sources of information we utilized our gamification knowledge and experiential and procedural learning principles to translate these requirements into implementation requirements for two virtual reality based self-led training applications. Frequent inclusion of future end-users in user-centred-design reviews within the implementation phase resulted in additional feedback and updated requirements that ensured high acceptance of the final applications. The final applications feature a three step self-led training approach: Initial training is assisted by a virtual robot trainer with speech interface, this is followed by a training phase where trainees are able to go through the procedures with or without text-based assistance (shiftable by the trainee). The final stage represents an examination where the trainee has to successfully go through the procedure without assistance. In order to evaluate acceptance and UX of the applications we conducted a qualitative evaluation with the future trainees. Therefore, we will report on the different requirements, the issues we encountered throughout the user-centred-design reviews and the results acquired in the final evaluation of the two applications.

Keywords: Experiential Learning, Phenomenological Learning, Safety Procedures, eXtended Reality.

1 Proposal

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The proposal length is 1000 words maximum (excluding references and appendices). Your paper may include works in progress.

1.1 Relevance to iLRN

Note our work presented in this paper we set out to create prototypical XR applications that utilize gamified and phenomenological [5], [4] as well as experiential learning theories [1], [2], [3] in order to be able to study the advantages and learning improvements that can be achieved by these approaches. Our aim with this paper is to share the experiences and learnings we have gathered throughout the whole process of this user-centred-design (UCD) implementation process starting with the stakeholder workshops, the derivation of technical and implementation requirements, results of the re-occurring UCD reviews and the qualitative evaluations with the functional prototypes in the end.

In the course of the presented implementations, we have first determined how medical procedure and safety-relevant learning content is currently taught in existing curricula. Furthermore, together with our customers we identified safety-relevant problems that might be better trained with XR and phenomenological learning approaches compared to currently used methods. This assumption is based on the fact that XR will enable trainees to perceive and experience the learning content (= converted into phenomena) sensually and physically (physiological reactions caused by digital stimuli are described exhaustively in the literature). Thus, the trainee is involved in the phenomenon in an individual (personal experience) and at the same time intersubjective way (possibility of subsequent digital observation of his/her own actions in a situation). In addition, the training content can be presented to each participant in an equally controllable and repeatable way, or to train dangerous moments in a repeatable way. Hence, the XR assisted learning process should result in better learning performance.

Another important question we set out to shed light on was the integration of these new digital technologies into existing training concepts. Therefore, we engaged with trainers in design fiction workshops to ensure that integration does not lead to an additional burden for trainers and to better understand what benefits for them could be achieved. Based on this data, we created learning scenario descriptions and transformed them into prototypical digital learning content and game-based learning approaches in a further implementation step. Based on these prototypical implementations, an empirical evaluation has been conducted with the stakeholder groups regarding learning experience and performance. In the context of this evaluation, the future acceptance of trainers and trainees and the socio-economic feasibility have been considered. We will present these results as we will make the respective implementations accessible at the conference.

1.2 Purpose and Objectives

The purpose and the objectives of the described implementations have been set as follows:

- Analysis of existing curricula with regard to the teaching of safety-relevant knowledge and the learning success in this area.
- Analysis of safety-relevant problems.
- Definition of scenarios for the (learning) of safety-related actions.
- Implementation of new digital learning concepts for the two use cases based on the scenario definition.
- Ensuring that the new digital learning concepts can be integrated into existing forms of training and distance learning.
- Empirical evaluation of acceptance, the training and education experience as well as the learning success.

2 Perspectives

The perspective of the work presented her are insights gained from practitioners regarding the implementation of XR training technologies in accordance with theoretical frameworks from phenomenological and experiential learning as well as gamification approaches. Furthermore, practical trainee feedback to XR training implementation will be presented and made available to the scientific audience throughout our poster appearance. Thereby, we will contribute implementation (can be tried out at the conference) and evaluation results from applications used in real world learning and training settings.

3 Conclusions and Recommendations

Through our real-world experimentation and evaluation, we have identified that the training of safety and medical procedures through XR technologies is well accepted by trainees and delivers improvements in learning transfer performance (time and retention wise). Furthermore, we have derived a description language that enables a semi- automatic creation of the content structure and related trainee (inter) actions. Such a description language can serve as input for following AI based refinements of automated content creation that would drastically reduce costs and content production time.

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