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Contributions, use and appropriation of a virtual environment for learning to perform dental procedures

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Abstract— This thesis is in the field of Information and Communication Sciences and focuses on the contribution of virtual reality to the learning of dental procedures. This is done through the study of the use and appropriation of a virtual simulation environment and the transformations engendered on the circulation of knowledge in a teaching-learning context.

Keywords— Virtual reality; training; dentistry, use, appropriation; simulation

Simulation has long been an integral part of training, particularly for the acquisition of technical skills. Industry, crafts, aeronautics, health, many sectors are concerned. In dental training (dental surgeons), students learn professional gestures on mannequin heads called "phantoms". In the last few years, a significant evolution has taken place in their programme with the introduction of virtual reality simulation.

The EVAGO (Virtual environment for learning to perform dental procedures) research project, funded by French National Research Agency, is being led by a multi-disciplinary team comprising researchers and doctoral students from the LIUM (Le Mans University Computer Science Laboratory), CREN (Nantes Education Research Centre) and RMeS (Regenerative, Medicine and Skeleton) laboratories, as well as an industrial partner (HRV simulation) and a university hospital centre (PHU4). The aim of the project is to improve the functionality of a virtual reality simulator called Virteasy Dental® and to develop teaching scenarios to incorporate it into the training of dental surgeons.

The thesis presented is in Information and Communication Sciences at the crossroads of Education and Training Sciences. The objectives are to study the contribution of virtual reality to the learning of the dental gesture, the use and appropriation by teachers and students of a virtual environment such as the one studied, the potential transformations engendered on the circulation of knowledge within a teaching-learning situation, and more broadly the integration of the simulator into training.

Virtual reality is a *"scientific and technical field that uses IT and behavioural interfaces to simulate the behaviour of 3D entities in a virtual world, interacting in real time with each other and with one or more users in pseudo-natural immersion via sensory-motor channels"* Fuchs, Moreau, Berthoz and Vercher (2006, p.8) [1]. It can be made up of various pieces of equipment, making it a *"multi-*

instrumental" technical device (Loison et al, 2023) [2]. The immersion and interaction induced by the use of virtual reality can therefore have an impact on its use and appropriation by stakeholders.

In the context of this complex study situation, we opted for a mixed method consisting of qualitative surveys using semi-directive interviews or focus groups, and quantitative surveys using self-administered questionnaires and filmed observations in teaching-learning situations. The questionnaires were constructed using the "Tam_INJ" instrumental acceptance scale applied to ICT (Caron, Heutte, 2017) [3]. Exploratory studies were carried out during the first year of the thesis with students and teachers to question their feelings and feedback on 1) the transition from "conventional" simulation on a phantom to simulation using virtual reality 2) the use of the simulator with and without a headset. A longitudinal study is currently being carried out with students and teachers using various protocols and organised into different phases:

T0: Surveys on perceptions of virtual reality

T1: Surveys on feelings and feedback on the use of the Virteasy simulator after one or two sessions

T2: Surveys of feelings and feedback on the use of the Virteasy simulator after several sessions

We can already see from our results that the use of the headset has an impact on the use, appropriation and circulation of information within the teaching-learning situation. We believe that it is possible to integrate the simulator into the teaching sequence depending on the appropriation and pedagogical progress of the students.

During the oral presentation at the Laval Virtual doctoral consortium, we will present the EVAGO research project and the simulator studied, the subject of the thesis, the research methodology and the analytical results of the exploratory surveys.

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