

8 | GLASGOW COMA SCALE SIMULATOR

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KEYWORDS

Health, Training, Serious Games, Virtual Reality, Patient Safety, Glasgow Coma Scale

ABSTRACT

In all health professions the use of serious games and VR simulation for training is increasingly adopted. Indeed, recent literature demonstrates the added value of immersive simulations to learn and improve the skills of health care professionals as well as their contribution to improving the quality of care, increasing patient safety, and minimizing the costs of training programs. In this project, we developed a simulation-based serious game allowing students and professionals to practice on the evaluation of the patients' state of consciousness according to the Glasgow scale.

Glasgow Coma Scale

EYE OPENING		VERBAL RESPONSE		MOTOR RESPONSE	
					
Spontaneous >	4	Orientated >	5	Obey commands >	6
To sound >	3	Confused >	4	Localising >	5
To pressure >	2	Words >	3	Normal flexion >	4
None >	1	Sounds >	2	Abnormal flexion >	3
		None >	1	Extension >	2
				None >	1



GLASGOW COMA SCALE SCORE

Mild
13-15

Moderate
9-12

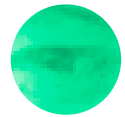
Severe
3-8



CONTEXT

The Glasgow Coma Scale (GCS) is a neurological instrument that measures the “severity” and extent of impaired consciousness. The GCS has become the most used tool in the world to document alterations in the level of consciousness caused by brain damage (Ingram, 1994). In combination with other neurological examinations, the scale is used to estimate the vital prognosis of patients with a severe brain injury. Because of its ease of use for all health professionals in all care settings, the scale has become an essential tool in all training programs. The neurological evaluation requires frequent simulation-based education to improve the cognitive, psychomotor and communication skills of the health students. However, current simulation approaches are resource-intensive and not routinely offered in all healthcare schools. Also, alternative approaches are needed to improve working memory, decision-making skills and teamwork performance. Serious games may be effective and more accessible alternatives if they use active, experiential and problem-based learning. They are indeed likely to solicit the student motivation and allow them to develop knowledge in complex learning situations.

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TARGETED ISSUE

GlasCoSS (Glasgow Coma Scale Simulator) is a gamified simulation tool allowing to immerse learners in realistic, but gamified VR situations in order to train them on GCS. The tool consists in placing the learner in challenging mission-based situations requiring to perform evaluations of patients encountered during the missions. With such a scenario, the patient diagnosis becomes one of the challenges to be met, thus motivating the learner and imposing various constraints: time, congestion, sound effects, noise, etc.

GLASCOSS HAS THREE OBJECTIVES:

1. Allow the student to experience a real situation in a virtual context and thus retain more information on the use of the Glasgow Coma Scale
2. Assess the possibility of using digital technologies to support active pedagogy, constructivist and socio-constructivist approaches.
3. Evaluate the potential use of the collected data in the simulation for educational research

Two major challenges had to be considered when developing GlasCoSS. The first was related to the modelling of patients to let the learner make a realistic diagnosis in accordance with the recommended professional practices. The second was the gamification of the simulation and the construction of a rich (various scenarios), customizable (customizable situations), and pedagogical (educational support) tool.

PROPOSED SOLUTION

GlasCoSS is a virtual reality simulation tool that enables to practice on the Glasgow Scale of Consciousness assessments of patients. This tool has been designed and developed by combining three essential aspects:

- › The realism of the medical diagnosis: indeed, the learning of the professional practices related to the evaluation of a patient’s state of consciousness requires a precision in the visualization of the vital indicators. However, in a Virtual Reality situation, it is not always easy to represent and capture these indicators. Taking the patient’s pulse is an example of this difficulty in the absence of a haptic device.
- › Gamification: we wanted to gamify the developed simulations to make the tool attractive and engage the learners’ motivation. Thus, the simulations are always implemented in the form of missions integrating patients that must be diagnosed in order to progress and obtain clues or resources. Several playful aspects have been used such as time, rewards, progression, and even collaboration, in a future version.
- › The integration of pedagogical supports: considering the intended use, it was necessary to integrate pedagogical supports in the simulation. These supports were integrated in the form of resources that the learner has in limited number during his missions and whose use requires counterparts.



RELEVANT INNOVATION

As mentioned in the previous section, the GlasCoSS project incorporates two interesting innovations. The first innovation is the transformation of the diagnostic process according to the GCS into an immersive virtual reality version. This transformation allows a viable and acceptable intermediary between the largely insufficient theoretical learning and the difficulty to achieve, and highly resource and time constrained real situation learning.

The second innovation of the project is to transform the training on diagnosis according to the GCS into a Serious Game in the form of an adventure game (Quests and Missions) and to transform the two serious processes of this training into gameplay elements. Indeed, with this simulation-based Serious Game, diagnosing a patient's state of consciousness becomes a challenge among others allowing to progress in the quest. Thus, by making the right diagnosis and taking the right decisions we can save the patient and obtain rewards in the form of clues and/or resources. The second aspect that has been gamified is the access to educational resources that become in our Serious Game resources like others that are constrained: limited number and costly. This even allows us to enhance the value of these resources in the learner's subconscious.

PROJECT OUTCOMES & RESULTS

The GlasCoSS project is still in progress. Currently, we are working in parallel but separately on the two essential components of the tool: the virtual patient with all the associated diagnostic mechanisms, and the adventure game that will integrate the patients as intermediate challenges. For both components, preliminary versions have been developed to validate the approach. We are currently extending them for a more complete and better finalized version. Realizing these components in a separate and modular way will make it possible to extend each one in a simple way and thus to make evolve the tool towards other possibilities of diagnosis and also towards other missions.

This project will create a learning environment where the student will work on the empirical aspects and the practical application of the tool, i.e. simultaneous learning of why and how to use the Glasgow Scale. We will thus promote the reflective practice of the participants by optimizing their clinical judgment in the evaluation and care of the patient with neurological impairment.



CONCLUSION

Over the past ten years, the studies have revealed a lack of rigor in the assessment of altered states of consciousness. We think that thanks to a tool like GlasCoSS, we will be able to improve the students' skills by playing the game and enhance their motivation, interaction, and engagement. These serious games could supplement traditional teaching and enhance access to neurological education. It should be integrated into the educational system and thus support students in their learning.

PERSPECTIVES & NEEDS

New technologies have invaded our daily lives and serious games are among the most promising educational options. Depending on the evaluation results, the authors wish to expand the use of serious games for teaching and learning purposes among students from other schools, professionals, health graduates.

We are also convinced that the development of a realistic virtual "Patient" linked to various diagnostic mechanisms (visual, sound, conversational, haptics) is a recurrent necessity for the development.

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