PrepaCare xr

Collection of Current Knowledge Creation in Healthcare

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1. Introduction

It is hard to imagine society without the use of digital media. Thus, a change is also evident in the field of education and training. Due to the COVID-19 pandemic, the sudden conversion affected all areas of life and especially in teaching and learning the trend towards digital technologies was intensified. Thus, online teaching as well as blended learning formats were used extensively [1]. Compared to traditional face-to-face teaching, online teaching requires a different kind of didactic concepts and measures to be effective and efficient. Learners are in a virtual environment, which might be challenging without appropriately prepared structure and support.

Simulation represents an exceptionally versatile and flexible technique. By means of technical aids, scenarios and environments are recreated in various degrees of reality. This proves to be particularly helpful in preparing for real situations. It is not possible to replace all learning components by a simulation. However, the users can learn and train different skills required for practice. This approach contributes especially to the understanding of the task and the structuring of activities [2]. The decisive factor here is that learners are provided with sufficient flexibility to contemplate and test their ideas [3].

In healthcare, continuing education and training is essential to keep this professional group up to date with the latest research and to provide patients with the best possible care [4]. Besides the basics, e.g. in anatomy, it is important to know and understand the materials and equipment to be used in different situations. Also, the standardized procedures in emergency situations have to be practiced in order to ensure a safe environment of the patients. Up to now, knowledge creation and training of medical workflows consists mainly of learning and repeating from books, scripts and similar materials, and performing role plays. One of the more interactive training scenarios includes simulation of use cases at the hospital by using mannequins. These are bound to certain time slots and rooms and are - depending on the range of function - very expensive. Therefore, not every hospital or institution is able to offer this training opportunity to their staff or students. It seems essential to be able to practice these procedures in a virtual environment beforehand. In this environment, medical students and professionals can practice situations in a risk-free and time-independent environment.

2. Collection of Learning Concepts

- Accelerated learning
  - Digitally prepared information from expert knowledge and research results is made available to enable immediate access.
  - *Limitation*: Learners have no direct contact with the experts.
- Competency-based learning
  - It has to be ensured that the necessary depth and/or the technical level of the already learned is mastered. Thus, a transition to the next topic is only made possible once the previous area has been understood. This review is assessed in the context of the practical approach.
  - *Limitation*: Practical approach requires the presence of a professional for review.
- Discussion-based learning
  - In small groups, learners should discuss problems and issues. It is designed to help promote critical thinking and independent learning. Emphasis is on identifying biases, weighing evidence, and testing conclusions.
  - *Limitation*: For untrained groups, a facilitator is recommended.
- Flipped classroom (Blended-learning)
  - Knowledge is acquired completely independently. The acquired knowledge is applied and deepened in presence phases.
  - *Limitation*: Presence phases require availability of an expert.
- Gamification
  - Modern game elements are used to promote commitment, enthusiasm and motivation for the topic to be learned.
  - *Limitation*: Depending on the task or the content to be taught, the effort to develop the learning methods increases.
- Mobile learning
  - Virtual and mobile accessibility enables access to digital media at any time.
  - *Limitation*: Visibility of some learning materials might be limited on a cell phone or any other mobile device.
- Online education
  - This method is less bound to the dependency of traditional face-to-face teaching. Based on different teaching media, the knowledge of the learners and the knowledge of the lecturers is connected.
  - *Limitation*: Personal contact is limited.
- Video-based learning
  - Combination of instructional videos or lectures that include images, audio, and even kinetic elements.
  - *Limitation*: Personal contact is missing.
- VR/AR integration
  - The advantage is a realistic and customized scenario. An integration of different teaching methods in a single application is possible.
  - *Limitation*: VR/AR based teaching methods require high effort to create suitable teaching materials; Hardware has to be accessible.

3. Collection of Learning Methods & Tools

- Hypertext
  - A text displayed including references to other textes (hyperlinks)
- Interactive videos
  - A video with additional multimedia-based interaction opportunities (e.g. pop-up graphics, tasks, quizzes)
- Online discussion
  - Forum based exchange opportunity, which may be linked with other learning methods
- Simulations
  - Hardware focused simulation of processes using dummies, for example mannequins or phantoms
  - Virtual simulations (see Virtual realities)
- Videos
  - Videos published on different platforms for presenting content and/or discussing use cases
- Learning platform
  - Web based application collecting and hosting the e-learning course material
- Virtual realities
  - Virtual environments mimicking defined environments and scenarios
- H5P (open source plug-in for interactive web-content)
  - Branching scenarios
  - Memory Game
  - Flash Cards
  - Interactive books
  - Virtual 3D-Tour
- Self-checks
  - Defined as non-graded self-evaluation method
- Images
  - Graphical representation of content
- Image Hotspots
  - Open source plug-in for interactive pop-up web-content (e.g. images, videos)

4. Possible Application Formats

Tools such as videos, images or interactive books can be used to acquire and consolidate theoretical knowledge. It allows the users to divide large amounts of knowledge into smaller areas and exercises. Thereby an overload can be avoided. Self-checks are a useful way to check what has been learned by the users themselves. Within the format of an interactive book, self-checks can e.g. be provided after each chapter (see Figure 1).

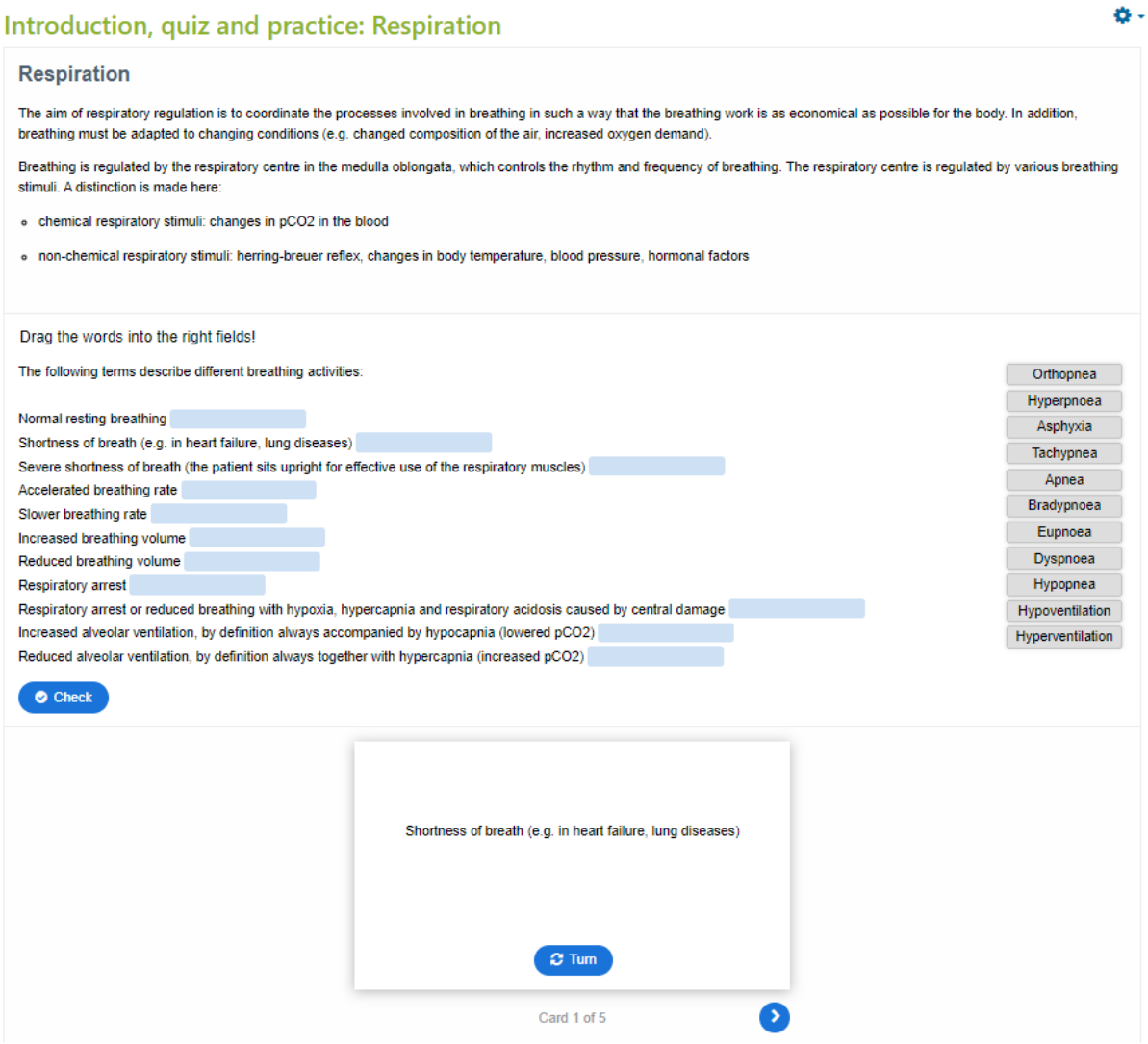

Figure 1: Interactive book. Beside text, video and images, a self-check can be provided after each chapter.

To get a closer approach to practice, simulations such as a branching scenario can help. Here the users are confronted with decision tasks. Depending on which choice is made, the course of the situation can change (see Figure 2). Within the branching scenario it is possible integrate interactive videos, pictures or text. Feedback on the users' choices can also be included during the scenario. To learn and understand devices and materials, additional Image Hotspots can help.

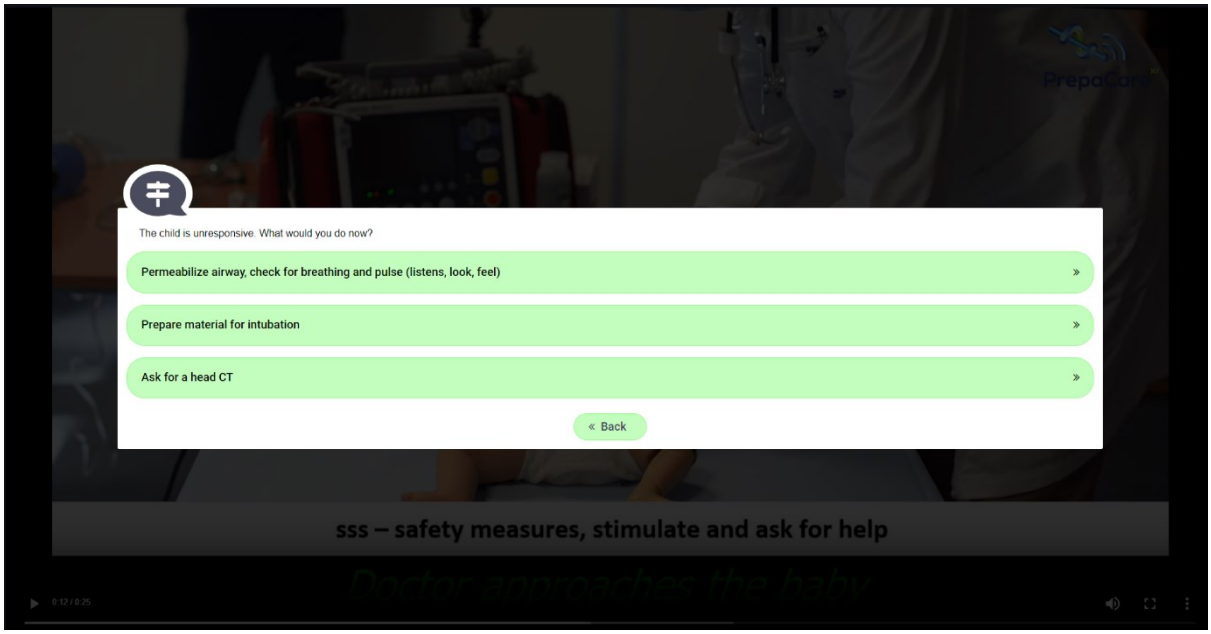

Figure 2: Branching scenario. Depending on the users' choice the course of the situation may change.

Furthermore, virtual tours through rooms and cupboards assist in getting familiar with the room itself and the equipment. For a more interactive experience, virtual reality could be applied. The learners can move freely in the virtual room and are able to view and touch the objects and devices virtually. Additional information can also be projected within the virtual environment (see Figure 3).

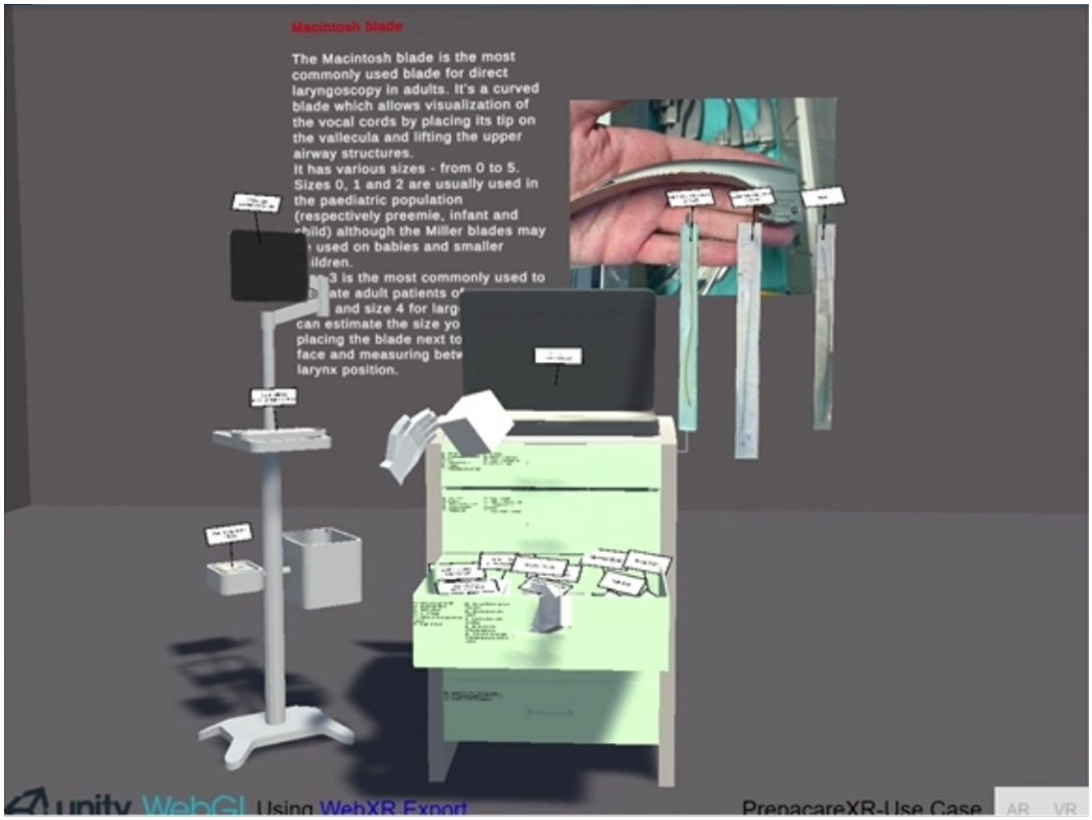

Figure 3: Virtual environment. Learners are able to view and touch material virtual. Additional information is displayed..

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