Simulation of eHealth Scenarios with Role-play Supported by an Interactive Smartphone Application

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Abstract. The transformation and digitalization of health services foresees a need for recruiting individuals with the combined knowledge of technical and health sciences. Education of young people in the domain of eHealth is an important contribution in the on-going digital transformation process. In this context, the research project *High School Students as Co-researchers in eHealth* aims to introduce technology-supported health care scenarios and research methods to young students in the Southern region of Norway. As a part of the project, simulation of eHealth scenarios was made in a clinical research laboratory together with high school students and experienced researchers. In the simulation, role-play was used to carry out the scenarios. To inform the roles, the tasks and their associated actions, an interactive smartphone application was used. This paper presents the simulation procedure and how the interactive smartphone was developed and used to guide the scenarios.

Keywords. Simulation, Health care modeling, Education and Training

1. Introduction

Health and social services are changing rapidly due to digitalization, and there is a need for individuals with a combined competence of computer and health sciences [1][2]. Combining health, organizational and technical issues is relevant for improving the technology-supported work processes. There is also a need for recruiting young people to contribute in the workforces of the future. At the University of Agder in Southern Norway, there has been a Centre of eHealth with a clinical research laboratory since year 2010 [3], where eHealth technology can be tested both in an early conceptual phase and during development regarding technical functionality, but also regarding impacts on organizational and clinical working procedures by use of multi test-room simulations were the interactions are observed and evaluated.

To introduce young people to eHealth, the research project *High School Students as Co-researchers in eHealth* was run as a collaboration between the University of Agder and high schools in Southern Norway, to allow high school students enrolled in a project

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course to learn about eHealth and research methods [4]. One of the learning objectives was to actively experience eHealth and as a learning method, a practical simulation was carried out in the eHealth research laboratory together with experienced researchers, where different eHealth-related scenarios were tested and carried out as a role-play. This paper presents the simulation procedure and how an interactive smartphone application was developed to inform the roles, tasks and their associated actions for the role-play used in the simulation of the eHealth scenarios

The research questions stated were: *How can simulation introduce high school students to eHealth in an educational and learning perspective? How can a smartphone application be used to guide the task flow in simulation of eHealth services?*

2. Methodology

As a part of the research project *High School Students as Co-researchers in eHealth,* 40 high school students taking a specialization in general studies, participated in an eHealth laboratory simulation during one day in September 2018. The high school students were 16 years old. The students carried out eHealth scenarios as a role-play together with researchers.

The project was led by the University of Agder and seven researchers within the domain of eHealth, having inter-disciplinary background from health informatics, computer science and health science were involved. In addition, one master student in Information and Communication Technology (ICT) was responsible for the conceptual and technical development of the interactive smartphone application used in the simulation. The role-play scenarios for the eHealth simulation were developed based on the experiences, results and technology from the research projects *Model for Telecare Alarm Services* [5][6] and *United4Health* [7][8], both performing several complex multi test-room simulations using the eHealth research laboratory infrastructure [9].

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3. Results

3.1. The Simulation Procedure and Scenarios

The learning outcome of the simulation procedure was how technology can help patients and support health service providers, by experiencing the different roles in a typical telecare or telemedicine scenario, by testing and interacting with devices. The simulation started with a short introduction about two scenarios to be carried out. Based on two pre-defined scenarios, the students in groups of 6-8 participants were assigned roles. The first scenario targeted a telecare situation which was: a) patient at home with a fall accident and triggering a telecare alarm with a GPS geolocation and communication device, b) telecare alarm service operator receiving alarm and communicating with patient and relevant services, c) municipal home nurse on duty for home visits, using a mobile phone device, d) family member with mobile device, e) physician and ambulance service with a mobile device and f) a group of 6-8 students observing in the observation room and following the interactions. The second scenario was a telemedicine situation which was: a) a patient performing measurements (pulse oximetry) regarding chronic obstructive

pulmonary disease (COPD) using a tablet device, b) family member to be notified, c) municipal home nurse for home visit, d) general practitioner for medical advises and e) a group of 6-8 students observing in the observation room. After each scenario a group debrief was made, where the students reflected on the scenarios and discussed how to improve them. The group switched the roles internally between the scenarios, to experience the situation through different roles.

3.2. The Laboratory Infrastructure

An eHealth laboratory was used that had three separate test rooms and one control- and observation room. The laboratory infrastructure is described in Figure 1. Test room 1 represented the alarm centre, Test room 2 a public health house and Test room 3 the patient's home. In the control- and observation room, the simulation was followed simultaneously on 4 large monitors, one for each camera source and one for merging the sources. Interactions between the test rooms were made only through technology and were guided by an interactive smartphone application. In each room, there was a moderator from the research team guiding through the simulation.

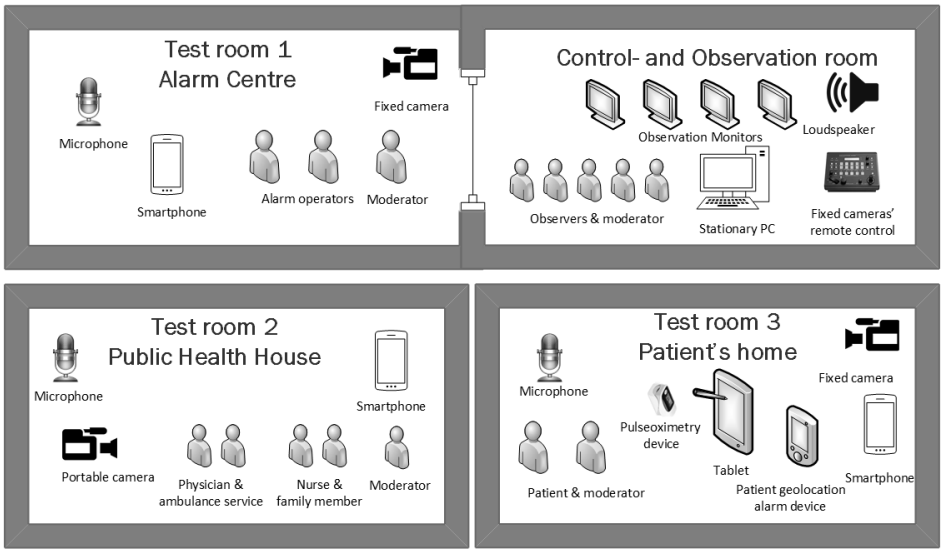

Figure 1. The eHealth laboratory with a multi test room set-up.

3.3. The Interactive Smartphone Application

To describe the roles and the associated tasks, the interactive smartphone application *eHealth role-play* was used. The application was developed as a basic web application using JavaScript, HTML and CSS. By basing the application on the web platform, it ensured cross platform compatibility, allowing the application to be accessed on any device having a web browser.

Upon opening the application, the user could select a scenario and then an associated role for the chosen scenario. Before presentation of the first task, a screen would display information about the tasks, explaining to the user the task triggers and guidelines to ensure a good experience for all the participants in the role-play. When a user chose to

start by pressing the start button on the screen, he/she was presented with the first stage of their role. Each of the roles had several stages that guided the user through the role-play. In each stage, there was a task trigger in the top card, which described the task trigger and task description. In this instance, the task trigger described what would have to occur before the user could start on the tasks in the bottom card. Once the user completed the tasks in the bottom card, he/she was able to go forward to the next task by pressing the next button. The progress between the stages was dependent on the different participants in the role-play, which could negatively affect the flow in the scenario and the experience of the role-play for the participants if the tasks were not followed precisely.

Figure 2. Screenshots from the smartphone application "eHealth role-play". From the right: 1) Start screen with choice of scenario, 2) Choice of role, 3) Information about the task flow and a start button, 4) A task with instruction and a next button to continue in the scenario.

Regarding the user experience with the smartphone application, the students used their own device to access the application on the web before the start of the simulation. There were initially some technical issues that were solved with a mobile hot spot solution. As the students had limited experience from health services they needed introduction to the different roles and having one moderator in each test room for guiding both in the role-play and regarding the use of the smartphone application was required.

4. Discussion

This paper has presented how high school students were taught the concepts of eHealth technology by applying theory into practice through laboratory simulation. Regarding the first research question on how to introduce students to eHealth in a learning perspective, the method of practical simulation in laboratory provided a student-centered approach endeavoring an early understanding of eHealth concepts. The simulation and role-play in the eHealth laboratory allowed the students to understand and experience realistic situations were technology would support the actors (health care providers, patient and family members) in handling the situation. About the second research question on how to guide the task flow in simulation, the interactive smartphone application *E-health role-play* was used instead of a traditional paper-based role description and task list. The idea was to use a device that all participants brought with

them and knew well. The application replaced the use of paper instructions and informed each participant about their role and the next task to perform. The moderators during the simulation were active and experienced researchers in eHealth, and the scenarios aimed to provide the students with insights and hands-on real problems to solve, but also reflecting on-going and recent research projects. As there is a need for recruiting new people into the eHealth domain, hopefully, some of the high school students will choose a related education and join the inter-disciplinary work force in the future.

This paper has some limitations, such as describing simulations made with students from one single high school. However, the paper has shared experiences and lessons learned regarding simulation as a teaching method for young students with the learning objective basic understanding of eHealth concepts. To conclude, the approach with simulation of eHealth service in clinical laboratory together with high school students and researchers provided the students with hands-on experience on real situations and how technology can be used. The interactive smartphone application replaced traditional printed papers and guided the task flow, even though there were issues that could be improved. Future work would include extension of the project period and recruit a larger number of high schools for enrollment. In addition, the smartphone application could be further refined by developing a new task handling solution based on the basic trigger concept described by Schulz in Listening to Teachers' Needs: Human-centred Design for Mobile Technology in Higher Education [11].

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