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Virtual Ward Round

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Abstract. "Virtual Ward Round" is a web-based blended learning tool. The program simulates hospital ward rounds. Within a virtual environment, students make diagnosis and order treatments. Tutors prepare cases easily to ensure realistic cases directly linked to the corresponding classes. The program "Virtual Ward Round" will hopefully be enrichment to the curriculum-based teaching.

Keywords. Education, Blended e-learning, Application, Ward round

1. Introduction

Currently, there are a few well developed e-learning tools available, for example the INMEDEA simulator [1] and CASUS Online [2,3]. Many of these tools are especially appropriate for simulating the workflow within a doctor's office, since one patient is treated in one specific episode of her/his disease.

In this present paper, we describe the development of a new blended learning tool called "Virtual Ward Round". "Virtual Ward Round" simulates a ward round on a hospital ward. The primary goal of the application is not exercising medical students in the treatment of specific diseases. "Virtual Ward Round" aims to transfer knowledge on typical medical processes in different hospital settings encouraged by the related tutors. In order to guarantee learning success the usage of this tool may be combined with courses or seminars.

2. Method

The Institute of Medical Education at the University of Münster conceptualized the idea of "Virtual Ward Round" and developed its professional content in collaboration with the Clinic and Polyclinic for General and Visceral Surgery at the University Hospital of Münster.

In 2010 the Institute of Medical Informatics at the University of Münster implemented the Internet portal "MeinCampus"[2] which unites several web applications. The development framework "Zend Framework" [4] is the basis of this portal and facilitates PHP [5,6] web developing in an object oriented manner. The application data is saved in a MySQL [6] database. The access to the portal is realized by a single sign-on solution which allows the user to access all enabled modules.

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"Virtual Ward Round" was developed as a complementary module of this Internet portal with appropriate technical characteristics. The application is available on the Internet and easily accessible by tutors and students. It is set up multilingual and offers the student to operate the program on an English or German user interface. The access control is realized by a simple role model, which ensures that each user has to sign on with her or his personal credentials.

3. Result

The administrator is authorized to create new wards within the application and to define the patient's characteristics and metadata for medical conditions in the corresponding ward. This determines the tutor's input options as well as the presentation of the program for the student. Hence, the pool of available medical examinations and diagnosis available to the student are dynamic in each ward. The system includes a pool of standard patients differentiated by age and gender. These patients have stored a range of standard findings and medical examinations.

3.1. Tutor's View

The tutor's primary interest is to pass on knowledge to his or her students, applying a sufficient set of self-selected medical cases. A major feature of "Virtual Ward Round" is the tutor's opportunity to add new cases easily to the application. The anamnesis and finding input documents are given and adjustable by the system administrator to enable the system's adjustment to fit the needs of the tutor.

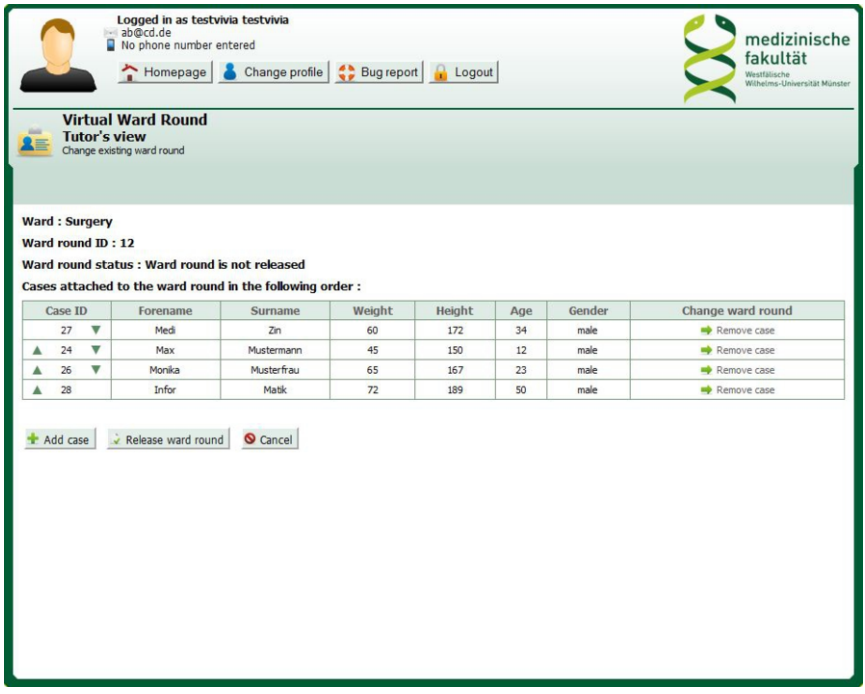

Figure 1. Tutor's view, creating a ward round.

The program allows the stepwise creation of a new case without risking of lose any information. The tutor defines the case's anamnesis information and specific medical findings. The available findings for each case are complemented by the pool of those defined within the profiles of the standard cases to avoid unwanted hints for students. Moreover, the tutor specifies which examinations are required, adequate and not adequate for the created case. Based on this information, the system evaluates the student's performance after finishing a ward round.

The tutor combines the cases to ward rounds, as shown in Figure 1. The cases can be integrated in multiple ward rounds and their order is easily modifiable within these ward rounds. The created ward rounds remain modifiable by the tutor, even after its completion and application within the system. During an adjustment session, the ward round under revision is invisible to the students.

3.2. Student's view

Another important feature of "Virtual Ward Round" is the active engagement of students in a decision-making process. Simulating physicians' work in a hospital ward, the student makes diagnoses and gives treatment recommendations of hospital patients.

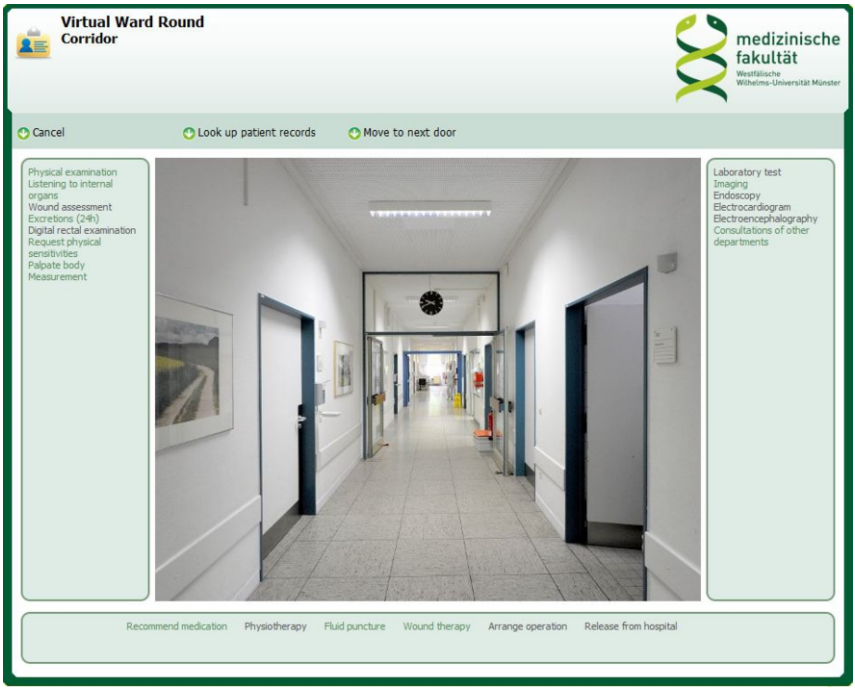

Figure 2. Student's view, starting a prepared ward round.

After selecting a prepared ward round, the student will be guided to the user interface, as shown in Figure 2, in which the student can check the patient records including the anamnesis and medical findings or enters the patient rooms directly.

The student has a large range of various examinations available. The selection of a appropriate examination needs to be done under the consideration of the patient's records and time consumption for the examinations. Each examination is linked to specific findings. If the student needs to review patient's records again a time penalty is

imposed and registered in the student's evaluation. The program's work flow encourages memorizing patient records and to consider them as the foundation of decisions on diagnoses and treatment recommendations.

At the end of the ward round, each student is evaluated upon the elapsed time and the appropriateness of the ordered examinations.

4. Discussion

With "Virtual Ward Round", tutors receive a useful tool to engage the students in an active decision-making process on medical treatment and make them familiar with common medical processes in a hospital setting. The setting of the program is chosen oppositional to previous e-learning systems which are mainly simulating the work process of doctor's offices [1].

The system gives the opportunity to educate all students with a standardized set of medical cases. In addition the application is user-friendly designed and highly accessible via the Internet. The content of the program is certainly relevant to the teaching and learning objectives of the medical curriculum. Other applications have pre-integrated cases and the creation of cases is long-winded and demanding. Although a set of well-developed pre-integrated cases is an advantage of these applications, these cases are not hand-tailored to specific learning objectives.

4.1. Benefits for the Tutor

Applying "Virtual Ward Round", the tutor gets the chance to integrate self-created cases easily into the e-learning system. Thus, the tutor is able to teach cases well known to him or her based on his or her own personal preferences. The previous established e-learning systems realize this feature only partially, since it is difficult to integrate a new case into the system [3]. For reason, the tutor's only option is to search for a similar case within the incorporated cases of the system.

In "Virtual Ward Round" the tutor is able to design ward rounds with an individual selection of cases to improve the student's memorization of patient records. This is a clear advantage compared to other systems which only teach one case at a time [1,2]. The application is a positive contribution to the retention of student's knowledge and can improve the tutor's teaching performance [7-9].

4.2. Benefits for the Student

"Virtual Ward Round" offers a wide range of advantages for students. The program introduces the medical students to the hospital setting by giving them the opportunity to act from a physician's perspective. The program offers a sufficient environment to get familiar with the work procedures and methods of hospital settings. Like the INMEDEA simulator, "Virtual Ward Round" "allows students to navigate freely within the system and to determine […] their next diagnostic steps [by themselves] at all times" [1]. The diverse approach of teaching improves the motivation to study and reach the education goals easier [10].

Generally it has been proofed that e-learning improves the efficiency in gaining knowledge and skills [11] and their retention [7, 8, 9]. The acceptance of a case-based computerized learning program (CASUS) was evaluated by A.B. Simonsohn and M.R.

Fischer in 2004 [10]. In the summer semester of 2001, the evaluation showed that 60% of the students classified the learning tool as useful, nearly 50% of the students stated that the teaching was "fun" and 42% felt more motivated [10].

4.3. Perspective

The implementation of the program has reached an early beta stage and the first testable prototype is nearly completed. The blended e-learning tool will be tested in the winter semester of the year 2011/2012 in collaboration with the Clinic and Polyclinic for General and Visceral Surgery at the University Hospital of Münster. The evaluation of the program will consider the ease of use, the user acceptance, the efficiency on learning and retention of knowledge. In case of a positive evaluation the application is expanded to other medical areas and becomes part of the faculty's curriculum.

References

[1] Horstmann M, Renninger M, Hennenlotter J, Horstmann CC, Stenzl A. Blended E-learning in a Web-based Virtual Hospital A Useful Tool for Undergraduate Education in Urology. *Education for Health*. 2009. Volume 22, Issue 2
[2] Franke C, Holzum A, Böhner H, Baehring T, Ohmann C. Computer-based case-study teaching in surgery. Springer Verlag; 2002. *Chirurg* 73: P. 487-491.
[3] Kolb S, Reichert J, Hege I, et al. European dissemination of a web- and case-based learning system for occupational medicine NetWoRM Europe. *Int Arch Occup Environ Health*. 2007. P. 553-557
[4] Weier O'Phinney M. Zend Framework. *The Official Programmer's Reference Guide*. Apress; 2010.
[5] Lecky-Thompson E, Eide-Goodman H, Nowicki SD, Cove A. *Professional PHP5 (Programmer to Programmer)*. John Wiley & Sons. 2004.
[6] Gilmore JW. Beginning PHP 5 and MySQL: From Novice to Professional. Apress; 2009.
[7] Ruiz JG, Mintzer MJ, Rosanne M. The impact of E-learning in medical education. *Academic Medicine*. 2006. Vol. 81, No. 3; P. 207-212.
[8] Clark D. Psychological myths in e-learning. *Medical teacher*. 2002. Vol. 24, No. 6, P. 598-604.
[9] Greenhalgh T. Computer assisted learning in undergraduate medical education. *BMJ*. 2001. Vol. 322, P.40-44.
[10] Simonsohn AB, Fischer MR. Evaluation of a case-based computerized learning program (CASUS) for medical students during their clinical years. *Dtsch Med Wochenschr*. Georg Thieme Verlag; 2004. P.552-556.
[11] Lyon HC, Ed D, Healy JC, et al. PlanAlyzer, an interactive computer-assisted program to teach clinical problem solving in diagnosing anemia and coronary artery disease. *Academic Medicine*. 1992. Vol. 67; P. 821-828.