Teleleren: Implementation and Acceptation of E-learning in a Hospital Environment

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Telelerik: Implementation and Acceptation of E-learning in a Hospital Environment

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ABSTRACT

The paper describes the implementation and acceptance of e-learning (electronic learning) in a hospital environment using off-the-shelf technology (Blackboard). Twenty-eight nurses participated in a pilot study that was designed to support an electronic course on advanced electro-cardiogram interpretation, a required skill for nurses working in cardiology and intensive care. The paper presents the procedure and the technologies used to support the e-learning activities over a period of 6-weeks. Tools such as chat, email, forum were used to support the communication amongst the nurses and with their instructor. As a follow up of the pilot study, a survey was built and distributed amongst the caregivers of the hospital (N=203) to gather their opinion about the implementation of such technology at the hospital. The paper concludes first that the content of the course, a socially structured e-learning environment, as well as the available technologies are important factors to a successful implementation of such e-learning project. The paper second concludes that the acceptance of such system to learn is widely supported amongst nurses but seems less convincing to paramedics and physicians. E-learning cannot be perceived as a substitute of a traditional face-to-face education, but when the e-learning environment is socially well structured, e.g., balancing asynchronous and synchronous communication as well as face-to-face interaction, it becomes an efficient support to education in the hospital context.

Keywords
e-learning, hospital, electro-cardiogram

INTRODUCTION

Healthcare caregivers evolve in a professional world where learning is an ongoing process that rapidly develops in term of treatment and associated technologies. Skills have to be developed or upgraded. Hospitals are environments that require caregivers to work in teams and around the clock. In one hand, the identity of each of the actors, their roles and attributes are clearly defined and homogeneous. In the other hand, the heterogeneity of the quality of the declarative and procedural knowledge as well as the communication amongst the actors is a key to efficient care. Traditional learning networks in the hospital environment are mainly based on a didactic and explicit relationship between the instructor and the students in the spirit of a community of practice. Face-to-face exchanges concerning patients and medical experiences favor implicit learning. Nevertheless, the same place-different time and heavy constraints of the agenda of caregivers increase their load of work when courses have to be taken. To support and facilitate the learning process a first pilot classroom-based learning environment was developed for a group of 28 nurses for a specific course on advanced electro-cardiogram interpretation.
E-Learning is a wide field where E-collaboration and virtual classroom has proven to be efficient way for both teachers and learners to discuss, exchange information and build shared knowledge amongst distributed participants (Hiltz, 1994; Jarveenpaa et al., 1998, Hiltz and Turoff, 2002; Vogel et al., 2001). The main advantage of such learning mode is to offer the participants the possibilities to engage in a learning activity at a convenient time from their working place or from home. One of its inconveniences is to reduce the social contact amongst the learners. Critical is also the intrinsic motivation of the participants to engage in electronic activities, when they are used to traditional face-to-face education methods. Drawn on the previous experiences of the authors in the e-learning domain (Rutkowski et al., 2002), we assume that a well structured e-learning environment supporting a balance in synchronous and asynchronous mode of communication, reinforced by face-to-face social contacts amongst social peers and with their instructors, should support efficient learning process. Indeed research has shown that when students are actively involved in a meaningful and memorable learning experience, completing practical experience for example, they tend to have a more stable long-term memory structure (Ramsden, 1997; Conway et al., 1992).

The paper first presents the design of the pilot run with the participation of 28 nurses taking a course in advanced electrocardiogram interpretation. It describes the socially structured e-environment that was provided to the pilot group and the protocol followed. Second the paper presents the results of the factorial analysis run on the survey collected amongst the hospital employees (N=203) opinion on the acceptation of an e-learning system and method at the hospital. The paper concludes with lessons learned, limitations and implications for further research.

IMPLEMENTATION OF THE E-LEARNING ENVIRONMENT

Catharina-hospital

Catharina-hospital is localized in Eindhoven (The Netherlands). The hospital (see Table 1.) offers education and facilitation of various professional trainings in cooperation with universities and colleges, top clinical cares and, also, is ahead in the use of advanced technology for diagnosis as well as therapy.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Catharina-hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website:</td>
<td><a href="http://www.catharina-ziekenhuis.nl">www.catharina-ziekenhuis.nl</a></td>
</tr>
<tr>
<td>Medical staff:</td>
<td>140</td>
</tr>
<tr>
<td>Employees:</td>
<td>3.000</td>
</tr>
<tr>
<td>Full time equivalent:</td>
<td>2.000</td>
</tr>
<tr>
<td>Beds:</td>
<td>600</td>
</tr>
<tr>
<td>Clinical patients:</td>
<td>about 25.000</td>
</tr>
<tr>
<td><strong>Ambulant-patients:</strong></td>
<td>about 250.000</td>
</tr>
<tr>
<td>Total budget:</td>
<td>about 210 million Euro</td>
</tr>
</tbody>
</table>

Table 1. Catharina-hospital

Blackboard course delivery system and course material

Blackboard Technology was selected amongst other e-learning systems as a main tool to support the E-learning project. Blackboard is a course delivery system with group support capabilities that enables participants or group of participants to enter information simultaneously in a structured manner, using a variety of specially designed tools such as chat, forum, email, file attachment. The system allows combining synchronous activities such as chat sessions as well as asynchronous activities such as discussion forum.
Group pages with restricted access were used to form groups of 3 to 4 nurses that could communicate about the content of the course. Heterogeneous groups were formed randomly in function of the nurses’ expertise in terms of informatics skills and years of experience in cardiology. The so-called “buddy-system” increased the chance of interaction amongst the participants and was designed to reduce social loafing effect or dysinvolvement from the course recognized as the dark side of such e-learning environment (Jarvenpaa et al., 1998). The group pages and the general discussion forum were structured in identical sub-forum that allows the participants to post their questions, feedback and comments about the course and the project itself. Examples of sub-forum were: controversial electro-cardiogram or statements, interesting websites, books and articles, technology and the electronic learning environment (Blackboard), general organization.

The course topic was on advanced electro-cardiogram interpretation. Electro-cardiogram interpretation is a required skill for nurses and physicians working in cardiology and intensive care. The course material (see Figure 1.) allows the extensive use and testing of the e-learning system in a socially structured environment. The topic of the course was particularly suitable to test such an e-environment due to the possibilities to present and discuss electro-cardiogram read-outs on the screen. The course material consists of advanced theory related to interpretation of the electro-cardiogram, including extensive practice in the interpretation of 12-lead electro-cardiogram. The course focuses on electro-cardiogram changes, which for instance occur with myocardial infarction, axis deviation, artificial pacemaker, defibrillation, cardioversion or the premature ventricular complex, medication etc.

![Figure 1. Example course material](image)

An electro-cardiogram content expert, a didactical expert, content electro-cardiogram intermediary as well as technical staff and editor supported the development, authorization and implementation of the learning material. Blackboard also allows the instructors to post announcements, email and guidelines about the course and to generate a grade book. Tools are also available to evaluate by means of quiz and survey the progress or difficulties of the participants and to provide adequate feedback (see Figure 2). The final test was available in electronic and paper form to reduce test-anxiety and control potential flaw in the system.
E-learning: A socially structure e-environment

The pilot was set over a 6-weeks period that is required to take the traditional course. The full pilot was based on the concept of socially structured electronic environments. This concept assumes that a well structured e-learning environment, supporting a balance in synchronous and asynchronous modes of communication, reinforced by face-to-face social contacts amongst social peer and with their instructors, will support efficient learning process. Therefore, to maintain social contact an e-learning classroom was organized with all material required (e.g., computers, printers, books) and facilitate by the presence of two blackboard instructors. This setting was designed to enhance the level of interaction amongst the participants and with the instructors as a face-to-face backup of the buddy system.

Appendix A. presents the organization of the socially structured e-environment over the 6-weeks period. Sessions typically lasted one and a half hour.

Preliminary results

The Blackboard system allows recording of the number of hits and provides an indication of the use of the system over the 6-weeks period. Interesting is to match this results with the performance of the participants and their opinion about the system before and after they have been involve in the project. These data are under score analysis and not yet available. This section of the paper presents the overall use of the system and particularly emphasize on the most used areas of the e-learning system.

The results indicate that the Content area containing course information as well as Internet links, tests and exams was the most visited (45%). The general discussion Forums that supported asynchronous communication amongst the participants and the instructor ranked second (25%) while the Group pages ranked third (9%) and the Announcements (7%) (see Figure 3).
The total amount of hits per day by all users (besides participants and guests) indicates that the participants mainly visited the Blackboard on Tuesday and Thursday (typically the busiest days in the hospital) and in the weekend (see Figure 4). It was not possible though to track the use from home location. Participants rather worked at night/evening (21%). The results depict well the around clock nature of the work of caregivers in the hospital context.

From the instructor perspective, his activities on the blackboard mainly concerned the communication area (70%, announcements, forums, group pages, chat and e-mail) and the content area (30%, learning material, tests and exams, teacher information). Interesting was that the chat tool was not successful during the pilot. Participants were not so enthusiastic and preferred to meet the instructors face-to-face. However, the chat facilities provide flexibility to the instructor that can be at any location to enter in interaction with the students when available. The chat tool could also support the presence and intervention of physicians occasionally or on agenda as well as video-conference. We could not organize such activities in this first pilot.
Table 2. presents the results in points (maximum 100) and numbers of attempt of the participants. There were 21 participants that took the exam. Eighty-five percent (18) of the participants passed the exam and 66% (14) succeeded at a first attempt.

The scores cannot easily be compared with the traditional course on interpretation on electro-cardiogram. Rates of success don’t differ, but there was no boarding test in the traditional course and no end–test in this form. However, compared with the traditional rate of success in e-learning environments the results are encouraging. (Rutkowski et al., 2002).

Generally the participants were satisfied “I learned a lot, I became wiser!” and also enjoyed the project “Overall I think it was a successful pilot! I had fun!””. They also thought that 6-weeks was maybe too short for the content and like the socially structured e-learning environment “The total time was too short”, “The design of the Teleleren pilot was good.” The participants also regretted the lack of animation and some flat aspects of the course, “Good course, but it remains ‘a book on the screen’, everything was very static: no use of multimedia (video, sound, etc.), this should be elaborated in the future”.

Participants also thought that some syllabus could be of help: “Learning from the screen is not easy for me! I immediately printed out the entire course. Maybe you can hand out a syllabus at the next course”, “It would be nice if you can supply the learning material in writing next time”.

The socially structured e-learning environment and face-to-face contact with the instructor was required to the success of the pilot: “Above all I need real contact with the teacher”, Teleleren is a good initiative, given that enough computers are available in for example a separate space where if possible, people can learn at fixed times and a teacher is present for face-to-face contact.”

Not everyone made use of the buddy system “Other members did not use the group section (no interaction here).” The small size of the group could explain this fact.

Interesting is that some of the comments underlined the meta-learning aspect of such course “You also learn to use the computer well this way” as well as the necessity to provide access at work in a e-classroom or at home “Unfortunately, because of my modem at home, I was forced to do everything on the computer at work”, “

Age, cohort, cognitive resources, education or previous experiences were not used as systematic factors to interpret the success rate. More over the size of the sample of participants does not allow drawing any strong conclusions. Indeed, the sample distribution of participants amongst the factorial design in function of age or IT experience could not be controlled nor balanced. However, experienced nurses felt less attracted using the blackboard system and rather like to be given the possibility to learn from paper rather than from the screen. Nowadays, a lot is to bet that with the development of IT most caregivers will enter the hospital and start their career with higher computer skills and more training in learning from the screen.
ACCEPTATION OF E-LEARNING TECHNOLOGY AT CATHARINA-HOSPITAL

A survey was built and distributed amongst the caregivers of the hospital (N=203) to gather opinions on the implementation of such technology at the hospital and in order to have a better grasp on the e-learning situation at the Catharina-hospital in terms of adoption and acceptance of e-learning technology.

Indeed, it appeared relevant to the authors to conduct such large survey research before to go on with the implementation of extended or based on different content e-learning projects.

The authors assume that the physicians are the experts and should be given the chance to express their opinions rather than to be forced in an e-learning environment that does not fit nor fulfill their very special professional needs. Therefore 28 interviews of one hour each, based on a strict protocol of a set of 10 open questions, was preliminary conducted with 28 participants. The 28 interviews were systematically analysed using constructivist content analysis method (McNamee and Gergen, 1992). Based on the identified categories, items were developed. The purpose of the in-house survey is a very specific tool for the Catharina-hospital. The authors are confident about the internal validity and for that very reason, they will not recommend the tool to be used as such for external validity issues. However, the Cronbach alpha indicated a good score of internal consistency within each categories (0.6<alpha<0.8) with an acceptable threshold of 0.6 as considered by Nunally (1967).

Participants

Surveys were distributed to the caregivers based on a random sample of one third of the relevant population (N=1558); five hundred five employees received the survey (Appendix B) amongst three categories: Nurse/caretaker (56.6%), Physician/medical students (16.6%) and Paramedic/Perimedic (26.8%). Two hundred nineteen respondents (43.4%) completed and returned the survey, covering 13.0% of the total population of the Catharina-hospital.

Participants that follow the pilot were not invited to fill in the survey in order to strengthen experimental validity. Two pre-test and post-test were specially constructed for the pilot study group of participants. Results are under analysis.

Analysis of the Data

In total 16 incomplete surveys were excluded from the research data set (N=203).

The results of the MANOVA (multiple Analysis of Variances) revealed only a significant effect for the independent variable Function (Wilks’ Lambda = 0.553, F(3,177) = 1.830, p = .002). Overall, the results of the ANOVA (Appendix C) indicated that nurses and caretakers are overall more satisfied with the learning structure within the hospital and feel more concerned in the development of course and new technologies such as e-learning program. Expected also participants who are already familiar with computer usage are more willing to adapt and learn via e-environment.

Due to a flaw in the research sample, CPA factorial analysis could not be run on the physician/medical student category and allow a balance comparison in term of category. The results are presented across the 3 categories and show positive correlations amongst the items representative of a positive and high level of acceptation amongst the participants of such e-learning system.

<table>
<thead>
<tr>
<th>Item</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Do you like working on a computer during your work activities?&quot; (13)</td>
<td>.679</td>
</tr>
<tr>
<td>&quot;Is a computer useful during your work activities?&quot; (12)</td>
<td>.676</td>
</tr>
</tbody>
</table>
| "Working on your own behind the computer is:"
  (19)                                                             | .647 |
| "What do you think of interactive contact with the teacher (for example e-mail, chat, online discussion)?" (20) | .625 |
| "Using the computer to learn is a useful addition to classroom learning." (18) | .597 |
| "How much can you personally profit from E-learning on a scale from 0 to 10?" (23) | .583 |
| "Using the computer for learning is useful." (7)                   | .582 |
| "What do you think of learning from a screen?" (22)                 | .504 |
| "How do you estimate your own basic computer skills?" (15)          | .495 |

Table 3. Factor loadings: Information Technology Factor (21.74%)
LIMITATION AND CONCLUSION FOR FUTURE RESEARCH

“In ancient times, learning networks occurred within one’s immediate family, community, and tribe (…)” (DeSanctis et al., 2003). Nowadays, Information Technologies bring new links amongst group of people learning together. However, things did not change so much: belonging to a tribe, meeting face-to-face remains important psychological factors to the success of e-learning implementation.

The research pilot conducted allows us first to conclude that a socially structured e-learning environment is important to support e-learning project. Participants should be free to choose for the method that fit their learning the best. Social contact with their social peers and instructor is a major factor to success. When implementation of e-learning fails in such a context, the reasons are mainly human or motivational (Rutkowski et al., 2002). Learning is a collaborative and interactive process. External motivation and feedback provided by the instructors are a key factor to success: “With E-learning it is important to still have the opportunity for personal contact with the teacher.” However, when the number of participants increases in the e-classroom it becomes crucial to support the instructor that has to crawl amongst thousands of comments and answers to give. Indeed participants have another representation of the virtual presence of the instructor and require imminent feedback as in face-to-face traditional classroom environment: “With E-learning it is important to get a quick response from the teacher.” A paradox is that because they often assume that social contact could lack and generate failure, they become more exigent toward the instructor. In following pilots, tools will be built and tested to support the instructor and satisfy the need of the participants: video-lecture, answers to questions will be available under the form of mini clip with possibilities to ask specifics questions.

It is also important to ensure the participants a possibility to access internet from home and their work place (Alavi et al., 1997): “I would like to learn at home and have unrestrained access to courses”, “Often it is impossible in the hospital to make use of the computer for personal objectives”, “Not everybody has a computer with Internet access at home, the hospital should anticipate this and provide employees the opportunity to learn”. Amongst the participants that fill in the survey, we could recognize some of the negative attitude toward e-learning: “E-learning sounds tiring for eyes and body posture”, “I cannot learn from a screen”. If participants will fail and lack motivation, the work of the team running such project spend even more energy to develop adapted structured. Age, experience and professional requirement as well as the material proposed are factors that will always influence the success of such project and should be carefully examined. The results of the survey revealed that the requirements are different in function of the category of the caregivers. Nurses, paramedics and physicians have different expectations towards e-learning system and will not all benefit equally from such environment. In future research, physicians will be addressed with Information Technologies that could support exchange and discussion amongst experts gathering material over the world.

Overall, we conclude that it is necessary to respect and to not enforce e-learning technology on potential users. The context, material and possibilities have to be studied and a socially structured e-learning environment built to assure the success of each project.

This research suggest that hospitals administrators should adapt this off the shelve technology for teaching their employees in a way that suits their working pattern in a better way. The research presented in this paper is in progress and two more pilots are actually run on different topics including Basic Life Support, and infusion technique and theory. The bottleneck of such e-learning project is to support the instructor when the number of participants extend. If the buddy system is efficient to some extend, more tools have to be developed to support the communication process between the instructors and the participants. Video will be used as a teaching support in follow-up pilot and effort will be oriented towards a socialization of e-learning environment. Blended e-learning as to remain focussed on human to human interaction in order to be successful (Vogel et al., 2001; Rutkowski et al, 2001)

Let’s end with a positive attitude that represents the general overview of the participants and the future of education “E-learning: a great initiative that should be implemented soon!”
ACKNOWLEDGMENTS

We thank Rob Kemperman and Anja Franken for the research they did for this project.

REFERENCES


APPENDIX A: ORGANIZATION OF THE SOCIALLY STRUCTURED E-ENVIRONMENT

<table>
<thead>
<tr>
<th>Session 1 – Introduction Blackboard and start-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform participants about the project and the content of the course</td>
</tr>
<tr>
<td>Introduce Blackboard technology and navigation tools</td>
</tr>
<tr>
<td>Start test to provide to their participant indication on their baseline knowledge</td>
</tr>
</tbody>
</table>

Introduction teacher and intermediaries

*Welcome*
- Research background
- Subject choice
- Explanation package
- Instruction start-test

Instruction electronic learning environment
- Starting up the computer
- Logging in to the Blackboard
- Announcements
- Navigation
- Forum
- Access to learning material
- Access to tests / exams

Start-test

<table>
<thead>
<tr>
<th>Session 2 – Group meeting and chat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer questions and solve problems</td>
</tr>
<tr>
<td>Introduce Blackboard (communication)</td>
</tr>
</tbody>
</table>

Experiences and questions week 1

Instruction e-learning environment
- Changing password and personal information
- Arranging participants in groups
- Group Page forum / Submitting a message
- E-mail in Blackboard
- GroupWise
- Chat session

Session 3 – Interactive guest lecture

Introduce some ‘modern’ medical technology to participants (e.g., implantable cardioverter defibrillator).

Structure:
- Introduction teacher
- Guest lecture by Jan Elders, subject is the ICD
- Interactive part (questions and discussion)

<table>
<thead>
<tr>
<th>Session 4 – Group meeting and demo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer questions and solve problems</td>
</tr>
<tr>
<td>Introduce several technical possibilities</td>
</tr>
<tr>
<td>Give participants explanation about the Internet</td>
</tr>
</tbody>
</table>

Experiences and questions week 2 and 3

Demonstrate simulation / animation
- Crossword puzzle
- Short Internet course
- Navigation in Internet Explorer
- Search on the Internet
- Saving files

<table>
<thead>
<tr>
<th>Session 5 – Pre-exam meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform participants on the structure of the final exam</td>
</tr>
<tr>
<td>Provide participants with the opportunity to ask questions in a traditional class</td>
</tr>
<tr>
<td>Practice for final exam</td>
</tr>
</tbody>
</table>

Experiences and questions week 4

Final exam explanation
- Face-to-face interaction with the teacher
- Discussion

<table>
<thead>
<tr>
<th>Session 6 – Final exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceedings of the Tenth Americas Conference on Information Systems, New York, New York, August 2004</td>
</tr>
</tbody>
</table>
Introduction
Dear Sir / Madam,
This survey has been designed to gather your opinion on the "Teleleren" project in order to provide an advice to the hospital relatively to the implementation of such e-learning project. E-learning is the combination of learning and IT (Information Technology). Teleleren is everything involved in the combination of traditional classroom learning and e-learning. This anonymous survey will take 10 to 20 minutes to be filled in.
There are no incorrect or correct answers. Please do NOT discuss the survey with colleagues before you are finished to fill it in.
Thank you for participation!

1) What is your favourite way of learning (please select the top 4, with 1 first choice, 2 second choice, etc.)

Rate
- Individual study
- Classroom learning
- Learning by book
- Learning by discussion
- Learning by group assignments
- Guest lectures
- Learning by doing
- Workshop / Seminar / Congress

2) What is important in order to learn?

a) Learning material being up-to-date
b) The amount of learning material
c) The way learning is facilitated
d) Usefulness to my job

3) The learning possibilities offered by the Catharina-hospital are: (with –5 very bad to 5 excellent)

4) Are you well informed about the learning possibilities within the Catharina-hospital? (with -5 very bad to +5 excellent)

5) How are you informed about the learning possibilities at the Catharina-hospital? (Please select your top 2)

- E-mail 'Bedrijfsopleidingen'
- Teamleader / Manager
- Colleagues
- Newsletter
- Intranet
- Other
- Not applicable

6) The hospital offers enough learning possibilities.

7) Using the computer for learning is useful.

Please rate the following two statements on a scale from –5 to +5:

8) Education offered by the hospital satisfies my learning needs.
9) Education offered provides solutions for practical problems in my work.

10) Please rate the following statements:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) The Catharina-hospital stimulates its employees to learn.
b) In your job it is required to be up to date with your profession.
c) In your job it is necessary to attend extra training / education from time to time.

11) How often do you use a computer during your work activities?

- Never
- Once or twice per month
- Approximately once per week
- More than once per week
- Every day
- All day

Please rate the following statements:

12) Is a computer useful during your work activities?

13) Do you like working on a computer during your work activities?

14) How important is the development of new technologies in healthcare?

15) How could you evaluate your own basic computer skills?

16) In case of problems with the computer, I… (please select the top 2)

- try to find out myself what the problem is
- ask a colleague / family member / friend for help
- call the hospital IT service desk
- use the help function of the program
- search the Internet / intranet
- stop working on the computer

Please rate the following statements:

17) Start levels of education meet your personal level

18) Using the computer to learn is a useful addition to classroom learning

19) Working on your own behind the computer is

20) What do you think of interactive contact with the teacher (for example e-mail, chat, online discussion)?
21) Please rank the following aspects of E-learning “Teleleren” from the most important (1) to the least important (8), using each mark only once.

Rate

<table>
<thead>
<tr>
<th>Not at all nice</th>
<th>Not nice</th>
<th>Neutral</th>
<th>Nice</th>
<th>Very nice</th>
</tr>
</thead>
</table>

Rate

- Possibility of doing courses at a time that suits you.
- Use of multimedia (video and audio).
- Possibility of doing courses at your own pace.
- Content being relevant, customized and up-to-date.
- The design of a learning environment.
- Possibility to review learning material.
- User friendliness.
- Possibility to take courses from your home place.

22) What do you think of the concept to learn from a screen?

- Not at all nice
- Not nice
- Neutral
- Nice
- Very nice

23) How much could you personally benefit from a e-learning project?

- Not at all nice
- Not nice
- Neutral
- Nice
- Very nice

24) Where would you like to use e-learning (Teleleren)? (More than one answers possible)

- At home
- At work
- In the classroom
- It doesn’t matter to me
- I don’t

25) Which forms of e-learning (Teleleren) have you been working with in the past? (More than one answer possible)

- Electronic communication with teacher and fellow student (e-mail, chat, online discussion, etc.)
- Cd-rom
- Electronic learning environment
- Use of a computer in the classroom
- Use of the computer at home
- Other
- None

The last part of this survey concerns descriptive questions that are important for statistical analysis. All data is anonymous and will be processed confidentially.

26) Your gender?

- Female
- Male

27) Your nationality?

- Dutch
- Other, being …………………………………………………………………………………………….

28) Your age?

- Younger than 20 years
- 21 - 30 years old
- 31 - 40 years old
- 41 - 50 years old
- 51 - 60 years old
- Older than 60 years
29) Since how long have you been employed at the Catharina-hospital?
   - Less than 1 year
   - 1 - 2 years
   - 3 - 5 years
   - 6 - 10 years
   - 11 - 20 years
   - More than 21 years

30) In which of the following categories are you employed?
   - Nurse / caretaker
   - Doctor / Senior house officer / Medical student
   - Paramedic / Paramedic
   - Supporting personnel

31) Your function is:
   - Executive
   - Educational / instructional
   - Both
   - None of the above

Reference:
32) What is the highest level of education you finished?
   - Basic education
   - VBO / LBO
   - MULO, MAVO
   - MMS, HAVO
   - HBS, VWO
   - MBO
   - HBO
   - WO

33) Do you have a computer at home?
   - Yes, with Internet connection
   - Yes, without Internet connection
   - No

34) How often do you use your computer at home?
   - Never
   - Once or twice a month
   - Approximately once a week
   - More than once a week
   - Every day
   - All day
   - Not applicable

35) Did you participate in the Teleleren pilot of the hospital?
   - Yes
   - No

Remarks:

Thank you for filling in this survey!
### APPENDIX C: EFFECTS OF THE ANOVA AND RESULTS OF THE STUDENT-T TEST

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Item</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>The results of the ANOVA conducted on item 3 revealed a significant tendency effect of the variable CATEGORY (F(2,178) = 2.955, p = .055) and show that nurses and caretakers (M = 2.16, StD = 1.862) think that the learning possibilities are better than paramedics and perimedics do (M = 1.30, StD = 2.171) on an 11-point scale.</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>The results of the ANOVA conducted on item 4 revealed a significant effect of the variable CATEGORY (F(2,178) = 4.412, p = .013) and show that nurses and caretakers (M = 1.03, StD = 2.393) think they are better informed about learning possibilities than paramedics and perimedics do (M = -0.32, StD = 2.583) on an 11-point scale.</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>The results of the ANOVA conducted on item 6 revealed a significant tendency effect of the variable CATEGORY (F(2,178) = 3.027, p = .051) and show that nurses and caretakers (M = 0.44, StD = 0.792) agree more that the hospital offers enough learning possibilities than paramedics and perimedics do (M = 0.08, StD = 0.829) on a 5-point scale.</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>The results of the ANOVA conducted on item 8 revealed a significant effect of the variable CATEGORY (F(2,178) = 4.212, p = .016) and show that nurses and caretakers (M = 1.38, StD = 1.910) think their learning needs are better satisfied than paramedics and perimedics do (M = 0.27, StD = 2.557) on an 11-point scale.</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>The results of the ANOVA conducted on item 9 revealed a significant effect of the variable CATEGORY (F(2,178) = 5.771, p = .004) and show that nurses and caretakers (M = 1.37, StD = 2.112) think education provides better or more solutions for practical problems in their work than paramedics and perimedics do (M = -0.03, StD = 2.713) on an 11-point scale.</td>
</tr>
<tr>
<td>6</td>
<td>10a</td>
<td>The results of the ANOVA conducted on item 10a revealed a significant effect of the variable CATEGORY (F(2,178) = 3.982, p = .020) and show that more nurses and caretakers (M = 0.52, StD = 0.867) think the hospital stimulates to learn than paramedics and perimedics do (M = 0.03, StD = 1.142) on a 5-point scale.</td>
</tr>
<tr>
<td>7</td>
<td>10b</td>
<td>The results of the ANOVA conducted on item 10b revealed a significant effect of the variable CATEGORY (F(2,178) = 5.667, p = .004) and show that paramedics and perimedics (M = 1.70, StD = 0.520) agree more that they are required to be up-to-date than nurses and caretakers do (M = 1.53, StD = 0.516) on a 5-point scale.</td>
</tr>
<tr>
<td>8</td>
<td>10c</td>
<td>The results of the ANOVA conducted on item 10c revealed a significant effect of the variable CATEGORY (F(2,178) = 3.310, p = .039) and show that nurses and caretakers (M = 1.43, StD = 0.603) agree more that it is necessary to have extra training / education from time to time than nurses and caretakers do (M = 1.33, StD = 0.624) on a 5-point scale.</td>
</tr>
<tr>
<td>9</td>
<td>13</td>
<td>The results of the ANOVA conducted on item 13 revealed a significant effect of the variable CATEGORY (F(2,178) = 4.033, p = .019) and show that more nurses and caretakers (M = 1.11, StD = 0.771) like working on a computer at work more often than paramedics and perimedics do (M = 0.70, StD = 1.151) on a 5-point scale.</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td>The results of the ANOVA conducted on item 14 revealed a significant effect of the variable CATEGORY (F(2,178) = 4.322, p = .015) and show that paramedics and perimedics (M = 1.65, StD = 0.484) find the development of new technologies in healthcare more important than nurses and caretakers do (M = 1.37, StD = 0.584) on a 5-point scale.</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>The results of the ANOVA conducted on item 18 revealed a significant effect of the variable CATEGORY (F(2,178) = 3.393, p = .036) and show that nurses and caretakers (M = 0.99, StD = 0.622) agree more that using the computer is a useful addition to classroom learning than paramedics and perimedics do (M = 0.76, StD = 0.723) on a 5-point scale.</td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>The results of the ANOVA conducted on item 22 revealed a significant effect of the variable CATEGORY (F(2,178) = 3.990, p = .020) and show that nurses and caretakers (M = 0.12, StD = 0.871) agree more that learning from the screen is nice than paramedics and perimedics do (M = -0.30, StD = 0.968) on a 5-point scale.</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>15</td>
<td>The results of the student-t test conducted on item 15 revealed a significant result of the variable GENDER (t(199) = -2.774, p = .006) and show that male employees (M = 0.69, StD = 0.963) think they have better basic computer skills than female employees do (M = -0.28, StD = 0.752) on a 5-point scale.</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>The results of the student-t test conducted on item 15 revealed a significant tendency result of the variable AGE (t(199) = 1.803, p = .073) and show that younger employees (M = 0.21, StD = 0.744) think they have better basic computer skills than older employees do (M = -0.08, StD = 0.741) on a 5-point scale.</td>
</tr>
<tr>
<td><strong>Years of employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>The results of the student-t test conducted on item 3 revealed a significant result of the variable YEARS OF EMPLOYMENT (t(199) = 2.898, p = .004) and show that employees with a short-term employment (M = 2.22, StD = 1.614) think the learning possibilities are better than employees with long-term employment do (M = 1.42, StD = 2.295) on an 11-point scale.</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>The results of the student-t test conducted on item 6 revealed a significant result of the variable YEARS OF EMPLOYMENT (t(201) = 3.139, p = .002) and show that employees with a short-term employment (M = 0.48, StD = 0.753) agree more that the hospital offers enough learning possibilities than employees with long-term employment do (M = 0.13, StD = 0.833) on a 5-point scale.</td>
</tr>
<tr>
<td>17</td>
<td>8</td>
<td>The results of the student-t test conducted on item 8 revealed a significant result of the variable YEARS OF EMPLOYMENT (t(200) = 2.579, p = .011) and show that employees with a short-term employment (M = 1.39, StD = 1.953) think their learning needs are better satisfied than employees with long-term employment do (M = 0.62, StD = 2.245) on an 11-point scale.</td>
</tr>
<tr>
<td>18</td>
<td>10a</td>
<td>The results of the student-t test conducted on item 10a revealed a significant result of the variable YEARS OF EMPLOYMENT (t(200) = 2.756, p = .006) and show that employees with a short-term employment (M = 0.55, StD = 0.869) think the hospital stimulates to learn more than employees with long-term employment do (M = 0.18, StD = 1.016) on a 5-point scale.</td>
</tr>
<tr>
<td>19</td>
<td>10b</td>
<td>The results of the student-t test conducted on item 10b revealed a significant result of the variable YEARS OF EMPLOYMENT (t(200) = 2.219, p = .028) and show that more employees with a short-term employment (M = 1.64, StD = 0.483) agree that they are required to be up-to-date than employees with long-term employment do (M = 1.48, StD = 0.543) on a 5-point scale.</td>
</tr>
</tbody>
</table>
| 20 | 10c | The results of the student-t test conducted on item 10c revealed a significant result of the variable YEARS OF EMPLOYMENT (t(198) = 1.999, p = .047) and show that more employees with a short-term employment (M = 1.46, StD = 0.635) agree that it is necessary to have...
The results of the student-t test conducted on item 12 revealed a significant result of the variable YEARS OF EMPLOYMENT (t(200) = 2.317, p = .022) and show that employees with a short-term employment (M = 1.31, StD = .766) think a computer is more often useful during their work activities than employees with long-term employment (M = 1.04, StD = .884) on a 5-point scale.

The results of the student-t test conducted on item 15 revealed a significant result of the variable YEARS OF EMPLOYMENT (t(199) = 3.501, p = .001) and show that employees with a short-term employment (M = 0.53, StD = .755) think they have better basic computer skills than employees with long-term employment (M = 0.14, StD = .815) on a 5-point scale.

The results of the student-t test conducted on item 19 revealed a significant result on the variable YEARS OF EMPLOYMENT (t(201) = 2.474, p = .014) and show that employees with a short-term employment (M = 0.85, StD = .826) like working on their own behind a computer more than employees with long-term employment (M = 0.56, StD = .837) on a 5-point scale.

The results of the student-t test conducted on item 20 revealed a significant result on the variable YEARS OF EMPLOYMENT (t(200) = 2.214, p = .028) and show that employees with a short-term employment (M = 0.52, StD = .929) like having interactive contact with the teacher more than employees with long-term employment (M = 0.24, StD = .902) on a 5-point scale.

The results of the student-t test conducted on item 6 revealed a significant tendency result of the variable EDUCATION LEVEL (t(195) = -1.786, p = .076) and show that less employees with a higher education level (M = 0.25, StD = .788) agree that the hospital offers enough learning possibilities than employees with a lower education level do (M = 0.46, StD = .841) on a 5-point scale.

The results of the student-t test conducted on item 15 revealed a significant result of the variable EDUCATION LEVEL (t(194) = 2.685, p = .008) and show that employees with a higher education level (M = 0.46, StD = .791) think they have better basic computer skills than employees with a lower education level do (M= 0.13, StD=.815) on a 5-point scale.

The results of the student-t test conducted on item 7 revealed a significant tendency result of the variable COMPUTER USE AT HOME (t(201) = 1.958, p = .052) and show that employees with high computer use at home (M = 1.18, StD = 0.668) agree more that the computer is useful for learning than employees with low computer use at home do (M = 1.00, StD = 0.601) on a 5-point scale.

The results of the student-t test conducted on item 12 revealed a significant result of the variable COMPUTER USE AT HOME (t(200) = 2.820, p = .005) and show that employees with high computer use at home (M = 1.31, StD = .758) think a computer is more often useful during their work activities than employees with low computer use at home do (M = 0.97, StD = 0.912) on a 5-point scale.

The results of the student-t test conducted on item 13 revealed a significant result of the variable COMPUTER USE AT HOME (t(200) = 3.097, p = .002) and show that employees with high computer use at home (M = 1.15, StD = .789) like working on a computer at work more often than employees with low computer use at home do (M = 0.76, StD = .927) on a 5-point scale.

The results of the student-t test conducted on item 15 revealed a significant result of the variable COMPUTER USE AT HOME (t(199) = 6.245, p = .000) and show that employees with high computer use at home (M = 0.59, StD = 0.736) think they have better computer skills than employees with low computer use at home do (M = -0.08, StD = 0.741) on a 5-point scale.

The results of the student-t test conducted on item 18 revealed a significant result of the variable COMPUTER USE AT HOME (t(201) = 3.121, p = .002) and show that employees with high computer use at home (M = 1.06, StD = 0.594) think the computer is a more useful addition to classroom learning than employees with low computer use at home do (M = 0.78, StD = 0.651) on a 5-point scale.

The results of the student-t test conducted on item 19 revealed a significant result of the variable COMPUTER USE AT HOME (t(201) = 3.121, p = .002) and show that employees with high computer use at home (M = 0.87, StD = 0.811) like working on their own behind a computer more than employees with low computer use at home do (M = 0.45, StD = 0.834) on a 5-point scale.

The results of the student-t test conducted on item 20 revealed a significant result of the variable COMPUTER USE AT HOME (t(200) = 2.994, p = .003) and show that employees with high computer use at home (M = 0.53, StD = 0.927) like having interactive contact with the teacher more than employees with low computer use at home do (M = 0.14, StD = 0.871) on a 5-point scale.

The results of the student-t test conducted on item 22 revealed a significant result of the variable COMPUTER USE AT HOME (t(199) = 2.850, p = .005) and show that employees with high computer use at home (M = 0.17, StD = 0.906) like learning from a screen more than employees with low computer use at home do (M = 0.21, StD = 0.897) on a 5-point scale.

The results of the student-t test conducted on item 23 revealed a significant result of the variable COMPUTER USE AT HOME (t(201) = 2.951, p = .004) and show that employees with high computer use at home (M = 1.55, StD = 1.792) think they can profit more from Telelernen than employees with low computer use at home do (M = 0.79, StD = 1.699) on an 11-point scale.