Contemporary e-Learning as Panacea for Large-scale Software Training

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Abstract: Large organizations renew their core business software with some regularity, resulting in serious challenges for in-company training officers. Especially when large numbers of employees need to be trained to use updated software on short notice, traditional face-to-face training methods fall short. Contemporary e-learning is regarded a solution for such short-term and large-scale training. This paper discusses the effect of a didactically sound e-learning solution on learning to use a new version of an Electronic Medical Record (EMR) software package. This solution not only features generally recognized e-learning characteristics like any time, place, path, and pace, but also marks the element 'just enough' to emphasize that the e-learning content only covers knowledge (concepts and procedures) necessary to perform the daily professional tasks. Around 2000 healthcare workers of a mental healthcare institution were educated online to use a renewed version of an EMR software package within two months. Results (i.e., time on task, test results, and perceived effectiveness) indicate that contemporary online solutions can help large organizations to face short-term and large-scale training problems.

1 INTRODUCTION

Organizations largely depend on business software, especially when this type of software supports core processes of an organization (Pinn-Carlisle, 1999). It is not uncommon that software companies renovate business software packages with some regularity. These new versions of core business software are a serious challenge for in-company training officers. Especially when large numbers of employees need to be trained to use updated software versions on short notice, traditional face-to-face training methods fall short. For instance, when 2100 employees need to be trained to use renewed software and a classroom-based setting is the customary option to train software skills, an institute would probably have to organize a minimum of 140 training sessions to train the total workforce (i.e., when a training session includes a four-hour training for 15 employees, directed by one trainer). If an institution has the disposal over one fully equipped training classroom (i.e., a room with at least 15 computers), this means it would take at least 70 days to instruct all employees of the institute, weather permitting it is possible to schedule two training session each day. In addition, such a training set-up

entails large organizational costs, since 2100 employees should get half a paid day off and receive travelling expenses to attend a training session. In situations like this e-learning is often considered a panacea for learning and instruction (Clark and Mayer, 2011; DeRouin et al., 2005; Driscoll, 2012; Jochems et al., 2004). Since learners can proceed through an e-learning course at their own place and pace, and at any time, organizational costs related to aforementioned organizational issues can be minimized. Moreover, contemporary e-learning offers opportunities for flexible instruction that is tailored to the requirements of learners (Clark and Mayer, 2011; Shute and Towle, 2003; Stoyanov and Kirschner, 2004). However, until recently for many organizations e-learning has proved long in lead time to produce, inflexible to amend and prohibitively expensive. Furthermore, the development and implementation of e-learning has been exclusively reserved to information technology experts, rather than educational specialists. Fortunately, due to a technology shift, new and relatively easy to use tools have become available for educationalists and trainers to facilitate e-learning development and implementation (Driscoll, 2012; Weller et al., 2005).

This paper describes a project that used user-friendly tools to create didactically sound e-learning courses for a variety of Electronic Medical Record (EMR) software users of Mondriaan, a large Dutch institution for mental healthcare. Around 2000 employees of Mondriaan had to be trained within two months' time to use an upgraded EMR software package called Psygis Quarant. Since employees needed to be trained on short notice and training facilities (i.e., availability of classrooms and trainers) were relatively scarce, it was decided to look for an e-learning solution. In addition, the intention to develop e-learning courses geared the adoption of contemporary instructional design guidelines for designing the courses. An example of a state-of-the art principle for designing instruction is the whole task approach as basis for creating learning tasks (Merrill, 2002; Van Merriënboer and Kirschner, 2013). According to Merrill (2002) "learning is promoted when learners are engaged in a task-centered instructional strategy. […]. A task-centered instructional strategy is a form of direct instruction but in the context of authentic, real-world problems or tasks. […] The effect of this strategy is enhanced when learners undertake a progression of whole tasks." The task-centered instructional strategy and other effective design principles, like the demonstration principle, the application principle, and the activation principle were employed to design the e-learning courses.

An important goal of the Mondriaan project was to study the effect of the instruction (i.e., the e-learning courses) on EMR skill learning. Therefore we explored student behaviour within the e-learning courses and analysed perceived effects of these courses on EMR skill learning. Results of the study were used to compare the e-learning approach to skill learning with customary classroom and onsite training methods.

The main research question of this exploratory study is:

- Is a contemporary e-learning method for software training effective and more efficient than a customary classroom training method?

In order to answer this question we formulated sub-questions (measurement between brackets):

- Do participants of the course perceive the course as effective / useful? (perceived effectiveness of so called superusers);

- What do participants of the course do in order to complete the course? (registration of time on task and testing results of all participants);

- Did the e-learning work? (identification of problems superusers faced within a four-week period after the introduction of Psygis Quarant).

2 METHOD

2.1 Participants

A total of 1973 employees of Mondriaan, a Dutch mental healthcare institution based in the south of the Netherlands, entered the e-learning courses. Participants belonged to one of four groups: (a) administrative staff (n=172; ADMIN), (b) nursing staff (n=956; NURSE), (c) psychotherapy/psychiatric staff (n=659; PSYCH), and (d) occupational therapeutic staff (n=186; THERA). For analysing perceived course effectiveness, evaluations of so-called superusers (n=100) were analysed. Superusers are representatives of the aforementioned groups. They function as contacts within departments and help solve problems users of the EMR software have. Further, they serve as intermediate between the EMR software user and information technologists of the Mondriaan institute. The superuser group included 26 administrators, (ADMIN), 33 nurses (NURSE), 32 psychotherapists/psychiatrists (PSYCH), and 8 occupational therapists (THERA).

2.2 Materials

2.2.1 Courses

For each of the four groups of users an e-learning course was designed. Each course consisted of two modules and a test. The first module covered an introduction to the EMR software and was the same for all users. The second module aimed at professional task learning and was different for the four groups. Each of these modules included between six and nine tasks. Instructional design principles for complex learning were used to design the learning tasks (cf. Van Merriënboer and Kirschner, 2013). Authentic tasks formed the basis for designing the learning tasks. Tasks were scheduled from easy (more instructional support) to difficult (less support). Table 1 shows an overview of the tasks covered in the courses for the four different groups.

For each task two or more exercises were designed with increasing difficulty level. During the first exercise learners were guided through the task.

Table 1: Overview learning tasks per user group.

Course ADMIN	Course THERA	Course PSYCH	Course NURSE
Registration and creating dossier	Appointments and dossier (4)	Appointments and dossier (4)	Report (6)
Unplanned activity (1)	Adapt appointment (5)	Adapt appointment (5)	Outside authorization (2)
Outside authorization (2)	Unplanned activity (1)	Report (6)	Consult archive (3)
Consult archive (3)	Outside authorization (2)	Consult archive (3)	Guidance plan
Add documents	Consult archive (3)	Anamnesis	Dialogue model plan
Make an appointment	Report (6)	Unplanned activity (1)	Gordon model plan
Outgoing correspondence	Create sub plan	Outside authorization (2)	
Register client	Day care plan	Medication	
Activity plan			

Note: Numbers indicate the same task is used for different groups. Tasks without number are unique.

In subsequent excercises guidance was faded and learner control had been increased. In the latter case feedback was only given after wrong user actions.

Each exercise starts with a realistic task description. An example of such a task description is: "*You just received the referral letter for Ms Post born 06-10-1951. You are going to register her and make an application for care for her. After that you will create her dossier. Ms Post has not been in care before.*" A task decription is followed by a 'guided interaction' with the EMR application. To develop the interactive exercises detailed scripts were written. In total about 100 of these exercises were developed for the four courses. Figure 1 shows a screenprint of an interactive exercise including feedback.

Ilias V4.2.3 (www.ilias.de) was used as learning management system. Ilias is an open source learning system that also includes authoring facilities for developing e-learning modules complying to the SCORM standards and tests using a wide variety of question types. Adobe Captivate 5.5 TM was used for building the exercises. Ilias was linked to a course/training management system called Edumanager (www.lnm.nl). Based on the function profile of the Mondriaan employee Edumanager could 'decide' which of the four courses should be offered. Ilias reported back to Edumanager when somebody passed the test of the course.

2.2.2 Tests

For each course a test was constructed containing an average of twelve multiple choice questions. Both test items and test were made in Ilias V4.2.3. Test items mainly focused on assessing (new) procedural steps. Further, questions related to the updated graphical user interface and questions aimed at assessing conceptual understanding were added to the test. Alternative answers of test items included 'anticipated errors', that is: possible errors identified by Psygis Quarant experts.

The cut-of score for the test was set at 70%. Because students were allowed to make the test multiple times, alternative answers to questions were randomized whenever possible. Ideally a question pool would have been constructed but time and resource constraints prohibited this. It was possible to quit a test and continue it later on which was practical because it could very well happen that a test had to be interrupted for more urgent work.

2.2.3 Evaluation Form

The evaluation form consisted of 10 statements that used a Likert-scale (1=completely disagree – 5=completely agree). Questions covered topics like course login, the course modules (content, sequence, readability), the test, and perceived effectiveness of the e-learning course. Questions were selected from the course evaluation database of the Open University of the Netherlands (Westera et al., 2007). Participants were able to add comments to each question.

2.2.4 Follow-up Questionnaire

Four weeks after the launch of the new EMR software a follow-up questionnaire was sent to the superusers. The questionnaire consisted of 14 questions, both multiple-choice and open questions. The questions covered problems encountered with the e-learning courses (how many, nature of problems), problems users encountered with the EMR (how many, nature of problems), and the evaluation of the e-learning tool. Questions were selected from Westera et al. (2007).
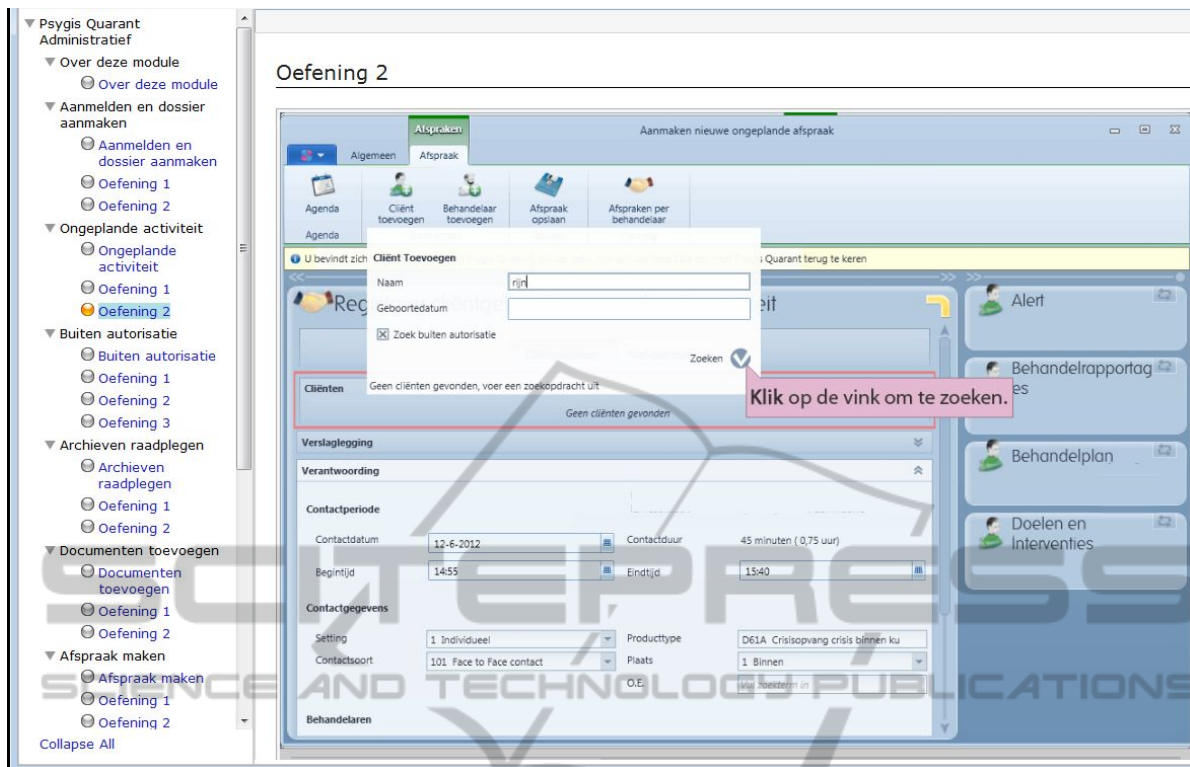
Figure 1: Sample screenshot from the e-learning course showing an interactive exercise including feedback.

2.3 Procedure

A project team was formed consisting of e-learning specialists from the Open University of the Netherlands and ICT-support and training specialists from the Mondriaan institute. A tight project plan was needed because there was only a six-month period between the start of the project and the start of the training of the employees. The project included phases for analysis, design, development, testing the course with 100 users, and implementation. The project was further complicated by the fact that it was the first time the electronic learning environment was used in the organisation. Moreover the project was used to train the Mondriaan project members to design and maintain e-learning courses themselves.

The first step for the project members was to get acquainted with the learning management system (Ilias) and to select the necessary authoring tools. It was decided to use the Ilias Scorm editor to build the modules for the course and use Adobe Captivate 5.5 TM for building the exercises. To construct the tests the Ilias test editor was used which supports a wide variety of question types.

During the design phase of the project examples were presented to a focus group for feedback. After the development phase the 100 superusers tested both the e-learning courses and the tests. Testing was done during ten workshops in August 2012. The superusers evaluated course and test content, time on task, and time on test, and filled in an evaluation form and a follow up questionnaire after four weeks. The superusers also provided the project team with valuable feedback and several errors could still be corrected before the e-learning courses and tests were finally implemented.

On 15 August 2012 all employees of Mondriaan received an email asking them to follow the course and complete the test before October 1st 2012. In the two months before the launch employees were already informed during plenary sessions and the company website. The progress during this six week period was closely monitored, reminders were mailed and in some cases department heads were informed that employees were lacking behind.

3 RESULTS

In order to answer the main research question of this exploratory study, three sub-questions were posed. In this section we will present the results necessary to answer the sub-questions.

3.1 Perceived Effectiveness

In order to measure perceived effectiveness, 100 superusers were asked to fill in a questionnaire after the testing session (a two-hour workshop). Seventy-two out of 100 returned the evaluation form. This group was very positive about the e-learning. Sixty-seven of 72 (93%) superusers indicated this form of learning was well or very well suited for learning to use an EMR. Also the specific course offered got good marks:

- The structure of the course is logical: 98% agreed or strongly agreed.
- Text was clear: 95% agreed or strongly agreed.
- Interactive exercises easy to understand: also scored 95%.

Answers to the questions about the tests were also positive, be it less outspoken:

- The questions were well formulated: 89% agreed or strongly agreed.
- The questions were well connected to the course content: 63% agreed or strongly agreed.
- Mastering the EMR software is tested well in this way: 72% agreed or strongly agreed.

3.2 Course Progress

What did participants of the course do in order to complete the course? Between 15 August and 1 October 2012, 1973 employees of Mondriaan followed the e-learning course and completed the test. During this six-week period, the e-learning ran without any significant problems. A few people complained they were offered the wrong course; this was corrected manually. After six weeks almost 80% of all Mondriaan employees had successfully completed the course. Table 2 presents the number of employees that followed and completed the e-learning courses and tests (successfully).

Table 2: Course completion rate.

	No. users	No. completed	% completed
ADMIN	172	132	77
PSYCH	659	483	73
THERA	186	151	81
NURSE	956	749	78
Total	1973	1515	77

Note: reference date 3 October 2012.

Table 3 presents the time participants spent on the course and the test. Overall it took the students about one and a half hour to complete the course of which about 20 minutes was spent on the test.

Table 3: Time on course, time on test and score test for each function group.

	Time course	Time test	Score test
ADMIN	1h46m	17m	88%
PSYCH	1h29m	15m	85%
THERA	1h41m	17m	84%
NURSE	1h22m	23m	80%

Note: reference date 3 October 2012

The average of one and a half hour for time on course was well within the two hours that was estimated for a classroom course on the topic.

The variation in study times suggests that the freedom learners have compared to classroom instruction is welcomed by many learners. Table 4 for instance shows a large variation in study times of the administrators (ADMIN) course learners.

Table 4: Study times in minutes related to number of learners that completed the ADMIN course.

Time (minutes)	0-30	30-60	60-90	90-120	120-150	150-180	>
Learners	15	12	28	33	11	11	26

3.3 Course Quality

Did the e-learning work? Four weeks after the launch of the new EMR application an online questionnaire was sent to the 100 superusers. After one week 59 out of 100 had filled in the questionnaire. The first two questions asked for problems with the e-learning. The amount of problems with the e-learning they received was limited. 75% of them received 5 or less problems during this period. Only a small amount of problems were actually related to the content of the course. Most problematic (19 times) was making the new password needed to access the course. Second were complaints about having the wrong course offered (usually outdated or wrong information in the personnel system). Several other problems were mentioned some of which very useful in the context of further development. But on a total of almost 2000 users the amount of problems was minimal certainly taking into account this was the first time e-learning was used. The question whether e-learning was a good tool to use for this kind of training was agreed with by 78% of the respondents.

Other questions looked into the problems users had with using the new EMR application. In this case more problems arose: 60% of the superusers received 5 or less problems during this period. But also in this case most problems were not related to

not being able to perform tasks but for instance to wrong authorization leading to wrong clients in the caseload. But some complaints clearly indicate potential improvement in the design of the training. For examples, several users complained some actions did not work while they simply needed to refresh the page they were working on. While this information was provided in one of the course modules it was clearly not practiced enough to be remembered in the working context.

4 DISCUSSION

Large organizations regularly face new versions of software applications. Especially when all employees of an organization use a specific application and both the old and new version of the application cannot be supported concurrently, the organisation is confronted with a major training challenge. This study explored the effects of an e-learning solution for large-scale software training when large numbers of employees need to be trained on short notice. Our research question was: *Is a contemporary (i.e., didactically and technologically sound) e-learning method for software training effective and more efficient than a customary classroom training method?*

A state-of-the art e-learning solution was developed since the regular training approach (a two hour classroom session for a maximum of 15 people) was not an option. The e-learning solution was founded on contemporary instructional design principles, like the whole task approach (cf. Van Merriënboer and Kirschner, 2013). First, this study explored the (perceived) effectiveness of the e-learning solution in order to be able to conclude that contemporary, didactically sound, e-learning courses can be given preference to classroom training and traditional e-learning solutions (i.e., the 'computerized page-turners'; cf. Jochems et al., (2004)). Results of the questionnaires of the superusers indicate that the e-learning courses and tests were effective and a large majority of the superusers stated that the courses are well suited for learning to use (updated) EMR software.

Analyses of the time on task of participants who finished their e-learning course showed that participants managed to finish the course within an hour and a half on average, which is less than the expected two hours. In addition a high percentage of the participants passed the concluding test, which proved they gained the knowledge base necessary to use the EMR software for daily professional tasks.

Also the effectiveness of the e-learning solution as perceived by the group superusers turned out to be positive. A total of 78% of the superusers concluded that the e-learning courses were ideal for training an upgraded version of the software.

The e-learning was designed using a "just enough" principle and succeeded in training the tasks users applied often in a time-efficient way. Ideally the learning is continued on the job using available online help facilities. However current online help does not take a task perspective but provides information on system commands and data structures. A more intelligent solution based on task recognition and active coaching (Breuker et al., 1987) might be more effective but this is still a topic for future research and development (Delisle and Moulin, 2002).

The e-learning solution proved to be effective and should be given preference to classical software training methods. Contemporary (open source) tools for developing the e-learning courses turned out to be useful and effective (cf. Dewever, 2006; Godwin-Jones, 2012). In addition, using present-day instructional theories for guiding the instructional design (Merrill, 2002; Van Merriënboer and Kirschner, 2013) contributed to good quality e-learning courses (as perceived by the participants).

For future research we propose two strands of research. The first strand aims at optimizing the quality of the e-learning courses. In order to improve the instruction for coming Psygis Quarant software updates, an educational design based research approach (McKenney and Reeves, 2012) will be used. The second research strand aims at generalizing findings. Since the results of the present study are based on a single case in one domain, it is our intention to replicate the design based research approach in other domains as well.

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