ESTABLISHING RELATIONSHIP BETWEEN PERCEIVED QUALITY OF LMS SYSTEM AND E-COURSE DELIVERY

Matjaž Debevc, Martina Breg

Faculty of Electrical Engineering and Computer Science, University of Maribor, Smetanova ulica 17, Maribor, Slovenia

Julija Lapuh Bele

B2 d.o.o., Ljubljana, Slovenia

Abstract: In this research, a quality of e-Learning has been measured on the basis of students' satisfaction with e-learning environment (i.e. LMS system) and e-Course delivery. A questionnaire has been developed to measure perceived quality of e-Learning technology and didactics. Results of this research also show statistically significant correlation between the quality of e-Learning environment and the e-Course quality in case of blended learning mode of delivery where only short introductory meeting and final examination are carried out face-to-face. Students who were satisfied with e-Learning environment were also satisfied with e-Course and vice versa. The research has been conducted by taking into consideration two different Learning Management Systems and eight e-Courses facilitated with different teachers.

1 INTRODUCTION

e-Learning can be described with three basic criteria: learning on demand, transfer of information to students, and implementation of virtual classroom (Rosenberg, 2001).

The success of any learning program is largely dependent on the motivation and attitude of learners. Therefore the key factors in e-learning delivery are usability and didactic effectiveness (Ardito, Costabile, Marsico, Lanzilotti, Levialdi, Roselli & Rossano, 2006).

Since ICT is a crucial factor in each e-learning setting, researchers emphasise various aspects to evaluate e-learning platforms and other learning applications (Ardito et al, 2006, Costabile, Marsico, Lanzilotti, Plantamura & Roselli, 2005, Dringus & Cohen, 2005, Squires & Preece, 1999, Zaharias & Poylymenakou, 2006). Quality of computer software often means usability (Nielsen, 1994).

Unfortunately, there is a lack of an evaluation model that enables quick and easy evaluation of e-Learning quality aspects. Existing models and questionnaires are time consuming and comprehensive (Bates & Obexer, 2005, Philips,

2005, Nielsen, 1994, Kirakowski, 1993). Since students do not like to fill out long questionnaires, such questionnaires are thus inappropriate for regular implementation after e-Courses.

Therefore, this paper focuses on the newly designed short-time e-learning quality evaluation model, which we call DEMA model. The questionnaire consists of only 28 items that cover the following indicators of students' satisfaction with LMS system and e-Course delivery:

- Usability,
- Users Communication,
- Functionality,
- Safety,
- Help and Support,
- Learning Satisfaction,
- e-Content Satisfaction,
- Gained Knowledge and
- Transferred Knowledge into Practise

The questionnaire is short enough to be implemented after the completion of each e-Course.

In this study, the following research question is also raised: is there a correlation between the perceived e-learning portal quality and the e-Course quality? Therefore, the following hypothesis has

been set: there is statistically significant relationship between the quality of e-Learning environment and the quality of e-Course. In the study, the term e-Learning environment refers to e-Learning portal, powered by Learning Management system (LMS).

There were total 197 students and 8 teachers involved in the study. Each student has attended one of eight blended learning courses (i.e. blend of face to face and facilitated e-Learning) and has been mentored by one of eight teachers. Face-to-face part of each blended learning course consisted of a short introductory meeting and final examination in classic classroom. The major part of each course has been conducted online. Participating students have used learning environments eCampus (Debevc & Bele, 2008) or Moodle (Martin-Blas & Serrano-Fernandez, 2009).

2 DEMA MODEL - QUESTIONNAIRE

In order to evaluate the quality of e-Courses and to design our own questionnaire, we have chosen Kirkpatrick's model (Kirkpatrick & Kirkpatrick, 2006) and adjusted it to the population that participated in the study.

Disadvantage of Kirkpatrick's model is in its complexity, in relation to a number of questions and the time needed to conduct evaluation and data analysis. Therefore, we have tried to search for a shorter, faster model, which would confirm our hypothesis that there is statistically an important relationship between the quality of e-learning environment (LMS system) and the quality of e-Course.

To reach these requirements, the Kirkpatrick's model, based on his first three levels, needed to be redesigned.

The goal of the anonymous DEMA questionnaire is to measure learners' satisfaction with e-Learning fundamentals, e-Learning environment and e-Course as well as to confirm or reject the hypothesis that the quality of e-Learning environment and e-Course quality are significantly correlated.

2.1 First Part - Quality of e-Learning Environment

The first part of the questionnaire evaluates the quality of e-Learning environment. This part consists of thirteen 1-to-5 rating Likert scales of quality measures divided into five categories and is based mainly on European Computer Driving License Certified Training Professional trainers evidence record (ECDL CTP, 2010), adapted for DEMA model.

It measures simplicity of use, ability of communication between users, functionality, security and additional help and support.

2.2 Second Part - e-Course Quality

The second part of the questionnaire evaluates the e-Course quality based on first three levels of Kirkpatrick's model. It consists of fifth teen 1-to-5 rating Likert scales of quality measures divided into five categories. It measures *learner's satisfaction* with course organisation, given information, teacher's support and meeting individual expectations. The second factor of e-Course quality is the *e-content* quality. The questionnaire measures intelligibility, conciseness, graphic design, quality of used multimedia and hyperlinks and quality of tests for knowledge evaluation.

The next factor measures the *gained knowledge.* Even though in most cases, the gained knowledge is evaluated with written tests, we have measured participant's opinion on gained knowledge.

The evaluation ends with questions about *usefulness of gained knowledge* (i.e. transfer of knowledge into practice).

3 RESEARCH

The purpose of this study is to confirm or reject the following hypothesis: there is a positive relationship between quality of e-Learning environment (i.e. e-Learning portal powered by LMS system) and e-Course quality in blended learning setting.

3.1 Methodology

3.1.1 Participants

Full-time students from Faculty of Electrical Engineering and Computer Science (FERI) and part-time students from B2 Vocational College have participated in the study. Each student has attended one of eight blended learning courses (i.e. blend of face to face and facilitated e-Learning) and has been mentored by one of eight teachers.

Students at FERI used LMS system Moodle while those students at B2 learned via LMS system eCampus.

3.1.2 Procedure

All participants attended blended-learning courses
(BL). Each blended learning course started in the
classroom, with an introductory face to face (F2F)
meeting. Teacher presented the course, announced
learning goals, learning tasks (e.g. project work,
assessments), code of behaviour within the course
and gave advice on e-Learning strategies. Then, the
e-Learning activities began. Most of them run
asynchronously. Students learned from e-content
(i.e. interactive learning materials that included
automated feedback and dynamic graphics such as
video, animations and simulations) and performed
learning tasks according to a weekly schedule that
determines learning activities (i.e. real-time online
meetings, readings, discussions, project work, on-
line assessments etc.). All activities had deadlines.
Students could carry them out according to their
own schedule. Teacher used the following activities
to facilitate learning:

- Followed student work and monitored their
  progress using LMS tools.
- Facilitated, motivated and encouraged students
  using communication tools.
- Stimulated communication and collaboration
  among students.
- Actively participated, promoted and led
  interactive discussions.
- Provided answers to questions, feedback and
  recommendations on course activities.

The exam was the last activity in the blended
learning course and the examination took place in
the classroom. After the exam, the students filled out
questionnaires.

The research was carried out during a period of
one semester.

3.1.3 Measurements

All participants filled out a questionnaire where they
specified gender, age group, school, course,
employment status and expressed their opinion on
the quality of e-Learning environment and e-Course
quality.

As we expected that individuals would attempt
to quantify constructs, which have not been directly
measurable, we have used multiple-item scales and
summated ratings to quantify the constructs of
interest (i.e. e-Learning environment quality, e-
Course quality). The quality of e-Learning
environment is measured with a scale of 13
questions and e-Course quality is measured with a
set of 15 questions.

For all questions, 1-to-5 rating Likert scale (1-
strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-
strongly agree) is used. New variable *portal quality*
is calculated as the arithmetic mean of 13 values,
which are measured with questions about aspects of
e-Learning environment quality. The variable *e-
Course quality* is calculated as the arithmetic mean
of 15 values is measured with questions about
aspects of e-Course quality. Both variables are
numerical.

3.1.4 Statistical Treatment

Since a new questionnaire is developed, it has to be
found out whether the instrument is reliable.
Therefore, Cronbach's alpha is computed to measure
the reliability (internal consistency) of scales for e-
Learning environment quality and e-Course quality.

Descriptive statistics are used to analyse
demographics data.

Pearson's correlation is performed to determine
if there is a significant relationship between the e-
Learning portal quality and e-Course quality. A
significance level of $p < 0.05$ is adopted for the
study.

SPSS is used for data analysis.

3.2 Results and Interpretation

3.2.1 Reliability of the Questionnaire

For each scale (e-Learning environment quality and
e-Course quality), the Cronbach's α is used to check
how closely a set of items is related as a group.

Values of Cronbachs' coefficients α are 0.913
(for the scale e-Learning environment quality) and
0.937 (for the scale e-Course quality). Since each
value is greater than 0.8, it can be concluded that the
questionnaire is sufficiently reliable. Alpha
coefficients, for both scales, are above 0.9, which
suggests that items have relatively high internal
consistency.

3.2.2 Participants

197 students participated in the study and they have
ranged from 19 to 64 years of age. 48% of
participants were males and 52% were females.
Participants used two different LMS systems. 53%
of them used Moodle and 47% of them used
eCampus. Each participant attended one of eight
e courses. Each e-Course was led by one of eight
teachers.

3.2.3 Participant Satisfaction

Participants' opinion on e-Learning environment (i.e. e-Learning portal powered by LMS system) quality and e-Course quality has been measured by descriptive statistics.

Descriptive statistics of portal quality and e-Course quality are reported in Table 1.

Table 1: Descriptive Statistics – all Students.

	N	Min	Max	Mean	Std. Dev.
Portal Qual.	197	1.5	5.0	3.94	.66
e-Course Qual.	197	1.4	5.0	3.93	.69

As it can be seen, participants assessed e-portal quality and e-Course quality rather high. The expected mean of both variables was 3 (neither unsatisfied nor satisfied). The measured values were almost 4 in the scale from 1 to 5.

Students who have used the LMS system Moodle have assessed their learning experienced as shown in Table 2.

Table 2: Descriptive Statistics - Students Using Moodle.

	N	Min	Max	Mean	Std. Dev.
Portal Qual.	103	1.7	4.8	3.75	.57
e-Course Qual.	103	1.4	4.9	3.69	.61

As it can be seen in Table 3, those students who have studied via LMS system eCampus have been on average a bit more satisfied.

Table 3: Descriptive Statistics for eCampus.

	N	Min	Max	Mean	Std. Dev.
Portal Qual.	94	1.5	5.0	4.13	.69
e-Course Qual.	94	1.5	5.0	4.19	.69

The descriptive statistics suggest a relationship between the variables. The question is, if this relationship is statistically significant.

3.2.4 Significant Correlation between Portal Quality and e-Course Quality

Correlation analysis is used to verify the relationship between numeric variables of portal quality and e-Course quality.

The following null hypothesis is set: there is no relationship between portal quality and e-Course quality in blended learning setting.

Firstly, it is checked as to which test is the most appropriate for our data?

Pearson's correlation is appropriate if two conditions are met: both variables are normally distributed and that the correlation between variables is linear.

To determine whether the variables are normally distributed, the Kolmogorov-Smirnov test is used to confirm normal distribution of both variables.

Scattered plot (Figure 1) shows a positive linear relationship between both quality measures.

The results from obtaining Pearson's correlation are shown in Table 4.

According to the obtained results, the null hypothesis is rejected and it can be concluded that there is a significant relationship between the portal quality and e-Course quality, $r=.804$, p (one tailed) <0.01.

Students who are satisfied with e-Course are also satisfied with e-Learning environment and vice versa.
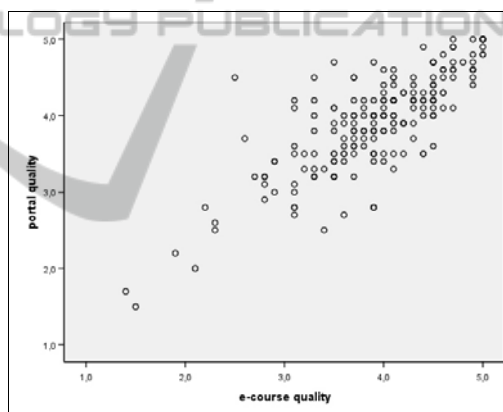

Figure 1: Scatter plot.

Table 4: Correlation.

		e-Course quality	portal quality
e-Course quality	Pearson Correlation	1	.804
	Sig. (1-tailed)		.000
	N	197	197
portal quality	Pearson Correlation	.804	1
	Sig. (1-tailed)	.000	
	N	197	197

4 CONCLUSIONS

The quality of e-Learning environment and e-Course quality is measured, in this research, with the use of, DEMA model, which has been developed in this

study. Evaluation results with this model prove that the quality of e-Learning environment and the quality of e-Course is significantly correlated.

On an average, it can be concluded that observed e-Learning portals show a positive attitude in relation to their use. e-Courses have also been assessed above expected average. From the evaluation, it was evident that there is a pattern in which case:

- Students who are satisfied with e-Courses are also satisfied with e-Learning environment.
- Students who are unsatisfied with e-Courses are also unsatisfied with e-Learning environment.

However, it is not evident from this research, which of these two factors (e-Course, e-Learning environment) has a greater impact on students' satisfaction. However, the role of the teacher, who tutored the course in e-Learning environment, is very important. He/she is the one who facilitates students' learning through the use of technology. He/she should use it in a way that technology helps students to learn efficiently and effectively. If LMS system is of good quality and does not cause any troubles to students, students probably assess technology useful, if they like the teacher's activities and e-Learning materials.

The experiment was carried out in case of blended learning courses with minor face to face part. Further research will show if there is also a significant relationship between e-Learning environment quality and e-Course quality in the case of complete e-Learning settings (i.e. courses without any face to face meetings).

In this study, DEMA model includes short questionnaire with 28 items. In future studies we will apply more extensive and standardised questionnaires for evaluating students' satisfaction with LMS system and e-Course as well as to verify the significance of correlation between e-Learning portal quality and e-Learning course quality.

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