

Evaluation of a MOODLE Based Learning Management System Applied at Berlin Institute of Technology Based on ISO-9126

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Abstract:

The use of eLearning is increasing dramatically, and most of institutions invest huge amounts in developing and deploying eLearning systems. As a result it is important to evaluate the benefits and the outcomes. Most recent researches emphasized that the use of eLearning systems is a success factor of any institution, and the main point is not whether eLearning is effective, but whether it is efficient or not.

In this paper we will study and evaluate the Learning Management System of TU Berlin, Information System for Instructors and Students (ISIS), that has been adopted since 2006, our focus will be on three characteristics of ISO-9126, which are usability, functionality, and reliability of ISIS. Our results will be presented in this paper.

1 Introduction

Most higher education institutions use a Learning Management System (LMS) to handle its needs of learning and teaching processes. Some institutions adopted commercial systems and some open source systems. TU Berlin employs a Learning Management System (ISIS) as a service for their over 27,000 students since 2006.

ISIS is a customized and enhanced version of the open source LMS MOODLE, developed by a team from TU Berlin to meet the increasing demands of interaction between teachers and students, managing electronic contents, and the quality of learning at TU Berlin. After four years of developing and applying this system, we started this evaluation process.

Evaluations are conducted to improve the effectiveness and efficiency of eLearning-There are different types of evaluations, such as formative and summative [3]. Formative ones are usually made through the development process of the project, where summative ones are conducted as the final assessment of the project, to judge the match between the expected results, the invested resources, and the goal achieved [3].

Wagner et. al. [1] defines summative evaluation as how effective the program has been or whether the research project has met its original objectives. Cronholm and Goldkuhl [2] introduced two different situations that can be evaluated: First the evaluation of the software (IT-System as such), which means to evaluate without any involvement from users and second, evaluation of software (IT-system in use), which means to study a use situation where a user interacts with software.

This paper is divided into seven sections. In the second section we briefly discuss ISO-9126, section three introduce ISIS and its services. Literature review is presented in section four, our

methodology in section five, results are presented in section six, and finally we conclude this paper in section seven.

2 ISO-9126

The ISO-9126 model is developed by the International Organization for Standardization (ISO). This organization was founded in 1946 to facilitate international trade, coordination, and unification of industrial standards by providing a single set of standards that would be recognized and respected [4].

The ISO-9126 model was developed in 1991 to provide a framework evaluating the quality of the software [5], and this model defines six characteristics and each characteristic has its sub-characteristics as shown in table-1. ISO-9126 model is a simple model for the non-specialists to employ, and it covers a wide range of system features [4].

Characteristic	Sub-characteristic	Explanation
Functionality	Suitability	Can software perform the tasks required?
	Accurateness	Is the result as expected?
	Interoperability	Can the system interact with another system?
	Security	Does the software prevent unauthorized access?
Reliability	Maturity	Have most of the faults in the software been eliminated over time?
	Fault tolerance	Is the software capable of handling errors?
	Recoverability	Can the software resume working and restore lost data after failure?
Usability	Understandability	Does the user comprehend how to use the system easily?
	Learnability	Can the user learn to use the system easily?
	Operability	Can the user use the system without much effort?
	Attractiveness	Does the interface look good?
Efficiency	Time behavior	How quickly does the system respond?
	Resource utilization	Does the system utilize resources efficiently?
Maintainability	Analyzability	Can faults be easily diagnosed?
	Changeability	Can the software be easily modified?
	Stability	Can the software continue functioning if changes are made?
Portability	Testability	Can the software be tested easily?
	Adaptability	Can the software be moved to other environments?
	Installability	Can the software be installed easily?
	Conformance	Does the software comply with portability standards?
	Replaceability	Can the software easily replace other software?
All characteristics	Compliance	Does the software comply with laws or regulations?

3 ISIS

ISIS was developed in 2006 at TU Berlin, based on MOODLE¹, to provide the staff and students of the university with an online teaching and learning environment. ISIS provides many services such as delivery of courses online, forums, emails, and delivering online exams and quizzes to students and grading them.

4 Literature Review

Many studies have been conducted to evaluate LMS's. For instance, Martin et al. (2008) [6] presents a usability evaluation of three well known open learning management systems (Moodle, Sakai and dotLRN) by applying a heuristic evaluation to these systems.

Meiselwitz and Sadera (2008) [7] use survey based techniques to investigate the relationships between usability factors and learning outcomes in an online learning environment.

Maria et al. (2008) [8] describes an integrated usability evaluation method empirically tested within an instructional setting in their university. Their results indicate that an eLearning system must adequately meet the needs of the instructional process and support learners' behaviors and actions.

Costabile et al. (2005) [9] introduce a set of criteria that capture eLearning systems features. Their results are obtained from a first phase of observations and analysis of people interactions with eLearning applications.

Chua and Dyson (2004) [4] propose the ISO-9126 model as a tool for evaluating eLearning systems, especially as metric for comparison of the various products available in the market. We decided to use this approach and its techniques to evaluate our system (ISIS), using summative approach based on ISO-9126.

5 Methodology

Our study was conducted online through the Intranet of TU Berlin, using the questionnaire of ISIS/Moodle to gather the users' answers. We developed a questionnaire consisting of 25 questions. Our questionnaire is based on several popular questionnaires: SUS (System Usability Scale) [11], CSUQ (Computer System Usability Questionnaire) [12], and the Web-based Learning Environment Instrument (WEBLEI).

SUS is developed by John Brooke in 1986, and it consists of 10 questions, presented to participants with a five point scale of strongly disagree to strongly agree. CSUQ is developed at IBM and it is composed of 19 questions, each with possible answers rating on a seven point scale of strongly disagree to strongly agree. WEBLEI is an instrument designed to capture the perception of the students about web based learning environment. For more details about this instrument, please see [10].

Our questionnaire is composed of 25 questions, 22 of them with ratings on a five point scale (1 Agree, 2 Somewhat agree, 3 Somewhat disagree, 4 Disagree, 5 Not involved), one

¹ <http://www.moodle.org>

question regarding the sex, one question about faculty, and a closing questions as open question for providing us with free form comments from the users.

This study is took place in the summer term of the academic year 2010. In this short paper we evaluated only the 19 questions regarding usability, functionality, and reliability. The total number of students at TU Berlin was 27,619 (Male 18,430, Female 9,189) for the academic term of the evaluation.² A total of 2,659 users (lecturers and students) participated in the study. 71 % of our sample is male and 29 % is female, and all faculties of TU Berlin were part of this sample as shown in table-2.

Humanities (10.3 %)	Mathematics and Natural Sciences (12.1 %)	Process Sciences (12.7 %)	Electrical Engineering and Computer Sciences (12.6 %)	Mechanical Engineering and Transport Systems (19.2 %)	Planning - Building – Environment (15.5 %)	Economics and Management (3.8 %)	Others (13.9 %)
105	302	450	390	726	284	362	40
4 %	11 %	17 %	15 %	27 %	11 %	14 %	2 %

Table-2: Participation by faculties, in brackets distribution of total numbers of students

6 Results

In our study we focused on three characteristics of ISO-9126, and its sub-characteristics, which are Functionality, Usability, and Reliability as listed in table-1.

The overall response of the 2659 users is shown in figure-2. For the data shown in figure-3, 85 % of the participants agree that the interface of ISIS is pleasant to use and that the organization of information was clear. For the privacy, only 51 % responded that they feel well-informed about the privacy of their data in ISIS (figure-4), and 72 % do not feel worried about their privacy when they are using ISIS (figure-5).

For the functionality of ISIS, 73 % of our sample agrees that ISIS has all functions and capabilities that expected to have, compare figure-6. Concerning usability, 82 % agreed that ISIS is easy to use (figure-7), 72 % are satisfied with the learning environment of ISIS (figure-8), 71 % can complete their tasks quickly using ISIS, and 78 % responded that ISIS helping them in their study (figure-9). For the reliability of ISIS, 46 % can recover easily when they made mistakes, and 45 % are happy with the support of the technical staff of ISIS, see figure-10. And finally we found that 98 % of the participants feel confident in using computer and internet, see figure-11.

² Statistics on number of students at TU Berlin for summer term 2010: http://www.tu-berlin.de/fileadmin/a70100710/Dokumentationen/Zahlen_Fakten/StudierendenstatistikSommersemester2010.pdf

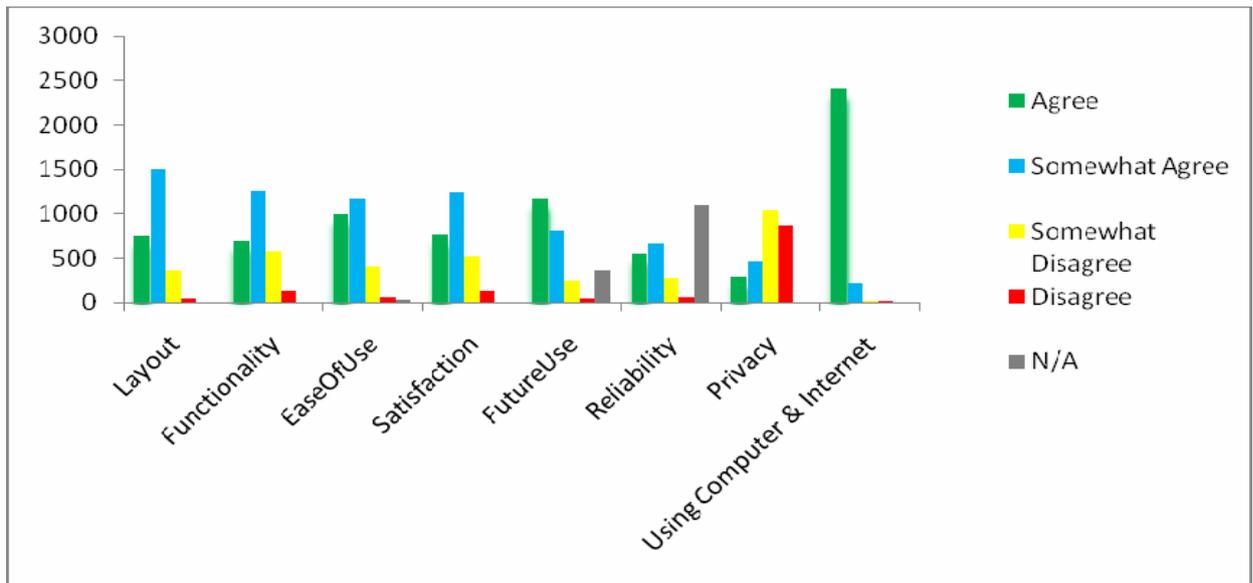


Figure-2: Overall response of users

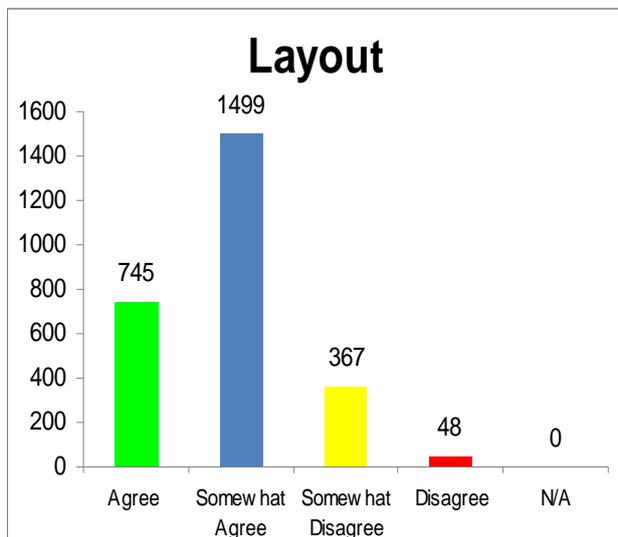


Figure-3: Layout

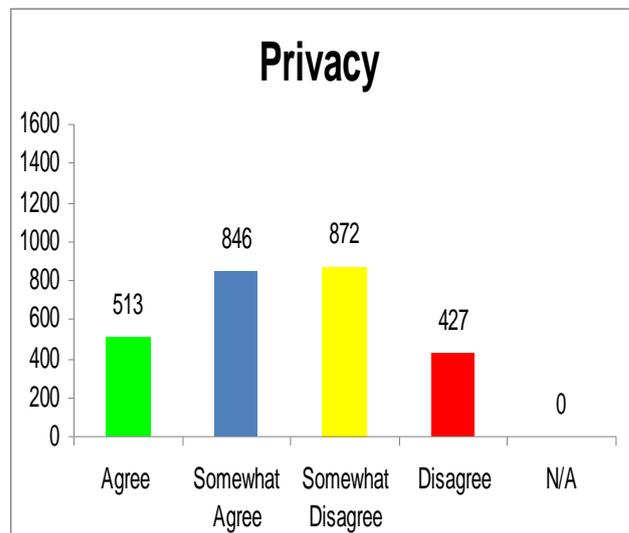


Figure-4: Users informed about privacy

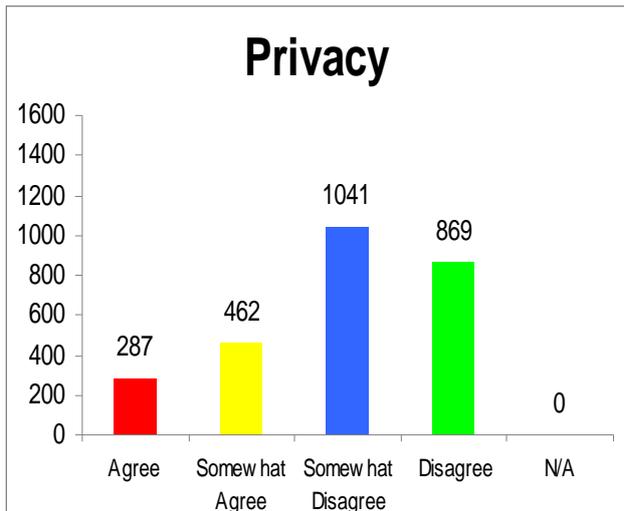


Figure-5: Users feel worry about privacy

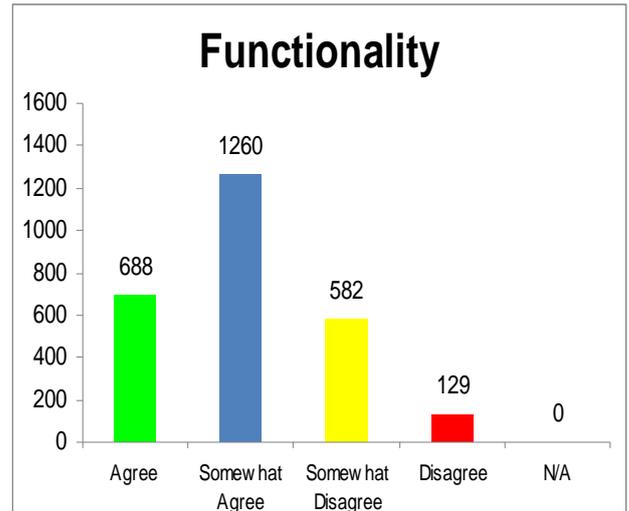


Figure-6: Functionality

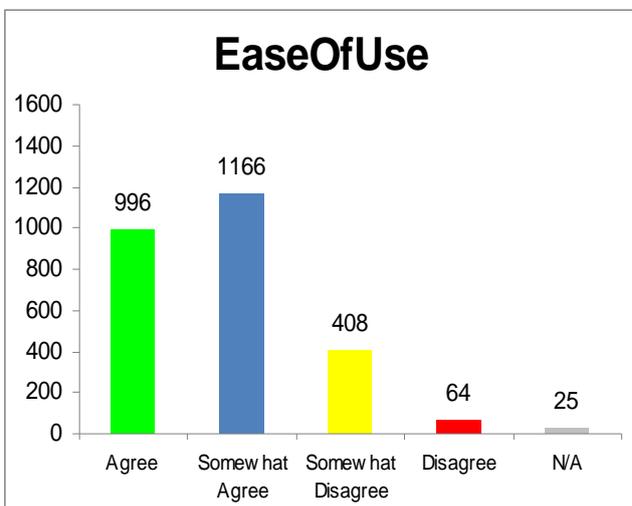


Figure-7: Ease of use

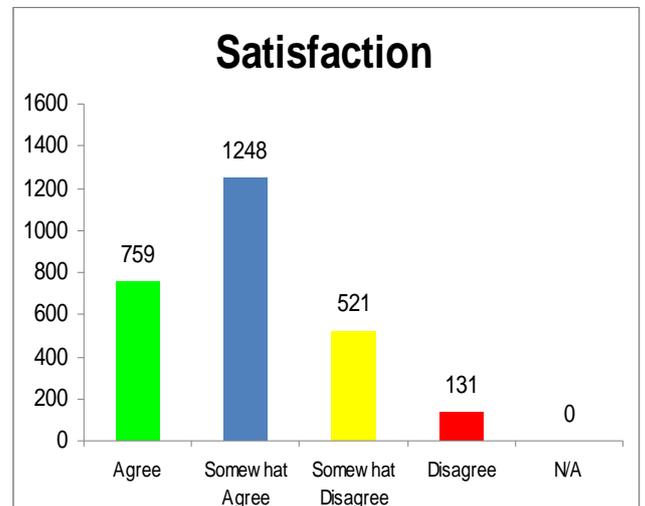


Figure-8: Satisfaction

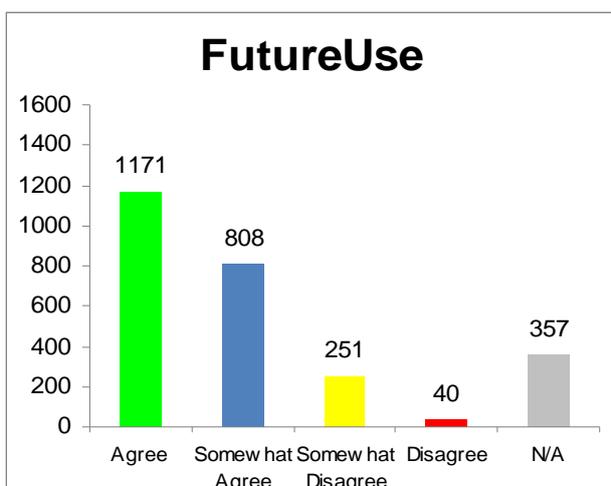


Figure-9: Average of two questions for future use

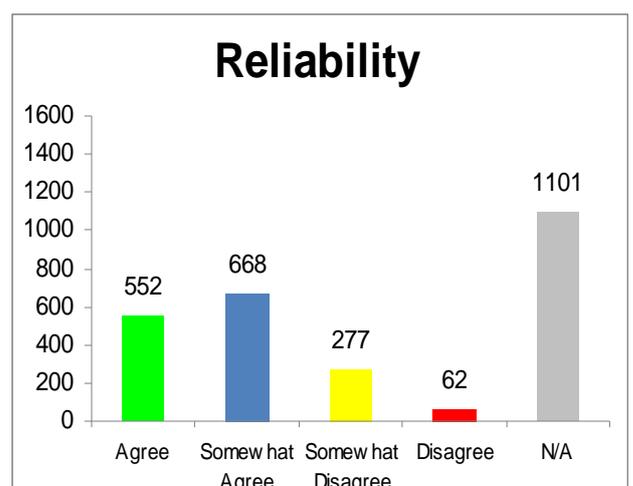


Figure-10: Average of two questions for reliability

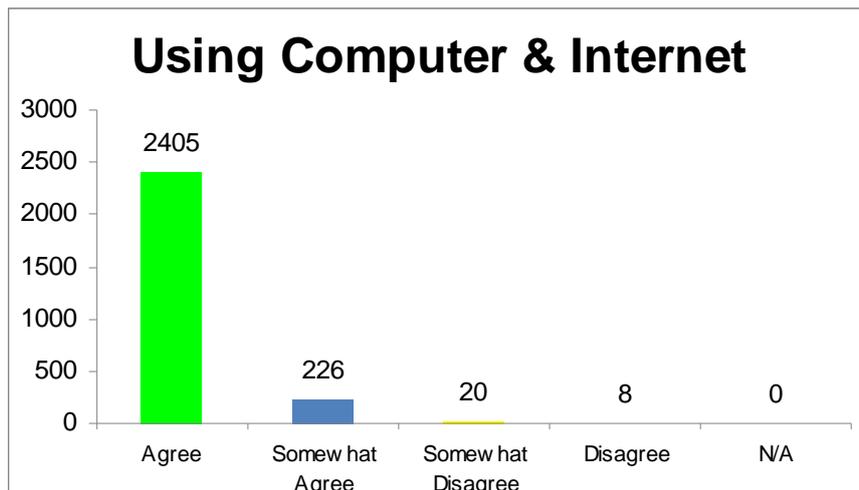


Figure 11: Confidence of using computer and Internet

7 Conclusion and Future Work

Evaluation is an important step to any LMS, in this paper we hope that this step was made. In this paper we used a questionnaire developed based on two questionnaires, which are SUS and CSUQ, to measure the usability, functionality, and reliability of ISIS, Information System for Instructors and Students, of the University of TU Berlin. Our results showed that the ISIS achieves most of its objectives as a LMS.

Not surprisingly these days, 98 % of our user sample feels confident of using computer and Internet, and there is no difference between the response of male and female students.

In usability and functionality aspects the system is very well received. However, the perceived reliability of ISIS can be improved. Looking at the statistics of our administrative server surveillance, we think most of these issues are caused by irregularities from other systems ISIS depends on. Examples are the general University network and the Universities LDAP identity server used for logins. As ISIS is likely the most-used web service of TU Berlin such general problems are often thought to be ISIS server failures. Fortunately, the TU Berlin network is in the process of being completely overhauled for a significant performance improvement until the end of the year. Also, a backup machine has been provided to the identity server, eliminating any further login problems so far. Even if we do not expect many of these types of incidents anymore: Our lesson learned is that we have to make the causes of service problems more transparent to improve user satisfaction.

The most critical aspect from the evaluation results are on the privacy issues, a very sensitive aspect in Germany. Moodle, the software base of ISIS, usually relies on the data-handling philosophy of Anglo-Saxon culture which often clashes with German views on data privacy. In fact, such issues are among the most predominant reasons for code changes from standard Moodle in ISIS.

The most prevalent data privacy complaint given in the free text answer was on lecturers being able to see the exact access times of students in their courses and on the materials. In fact, we disabled this very feature more than a year ago. However, this seems to be not well-known to student users and they still feel observed. As a conclusion, we need to improve our information processes towards our users.

In summary, this study gave us the opportunity to do more improvements and further evaluations and analysis, to provide TU Berlin with an online learning environment using open source technology.

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