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A SYSTEMATIC APPROACH TO IMPROVING E-LEARNING IMPLEMENTATIONS IN HIGH SCHOOLS

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BSTRACT
This study was based on the current growing trend of implementing e-learning in high schools. Most endeavors have been inefficient, rendering an objective of determining the initial steps that could be taken to improve these efforts by assessing a student population's computer skill levels and performances in an IT course. Demographic factors were also taken into account while formulating these recommendations. Basic computer skill levels were measured through the administration of the Technical Survival Skill Test (TSST) questionnaire, developed by the University of Toronto. Academic performances were evaluated through several assignments designed by the IT course instructors. The main result of this study indicated that computer skill levels did have a direct correlation with a student's academic performance level. The database was further parsed based on demographical factors, resulting in a set of recommendations to enhance the effectiveness of e-learning.

Keywords: learning management system, LMS, technical survival skill test, TSST

INTRODUCTION

Through recent times, the Information and Communication Technology (ICT) has steadi become a part of the curriculum in numerous educational institutions, i.e. the use e-learning, which utilizes Internet technology in delivering learning experiences (The Herridge Group Inc., 2004). A form of this delivery method called the Learning Management System (LMS) mediates both the administrations of course instructions and materials (Brown & Johnson, 2003) and the tracking of student progress.

E-learning is currently being developed by several educational institutions for all grade levels, including those in high school. As Ceriejo states, there are some tangible benefits in using e-learning. Many researchers find that these benefits, experienced by both students and instructors, include the asynchronous nature of online learning, the flexibility in ass activities based upon the students' schedules, and the personalized feedbacks (Saadé, Kira, & Dogmoch, 2007). In order to successfully implement e-learning, some possible barriers ought to be minimized. One ba r would be the participants' basic computer skills (Vecchio & & Loughney, 2006; Nedelko, 2008). At post-secondary education level, the University of Toronto establishes a standard scoring system for basic computer skills required for a proper implementation of an e-learning program.

Within Indonesia's education system, high school commences at the tenth grade level, which is a critical period for e-learning utilization since it is the introductory period when students need comprehensive guidance on how to navigate through an e-learning delivery system. The success of using e-learning at this grade level serves as the basis for further e-learning implementation in subsequent grade levels. The findings of this study would help a school in determining strategies t adopt for ensuring a successful e-learning implementation at the high school level. For this reason, the focus of this study was on the implementation of e-learning in a tenth grade course; in this case, the specifi ourse selected was on Information Technology (IT). This study aimed to examine the correlation between students' computer skills and their academic performance within the IT course. A pre-evaluation was performed to determine whether there were differences among the computer skills of the students, based on various demographic factors prior to e-learning utilization.

learning Concept

E-learning is a dynamic process rather than a static one. With the gression of time, e-learning has been redefined and refined based on recent technological developments. The Herridge Group Inc. (2004), Cross (2004), Fournier (2006) as well as Garg and Jindal (2009) have reached a convergent conclusion that e-learning can be defined as a method to es blish teaching and learning process through the use of Internet and information technology devices. E-learning comprises three essential elements (Anderson, 2004): the teaching process (the teacher), the learning process (the student), and the content or knowledge (delivered through the Internet). Figure 1 depicts a model that maps the interactions among the three elements, which result in six types of relationship

pairings: student-student, student-content, student-teacher, teacher-teacher, teacher-content, and content-content. Furthermore, Table 1 shows examples of ICT that could facilitate the interactions among those elements.

Figure 1. Interaction Mapping Among Student, Teacher, and Content through the Use of Technology

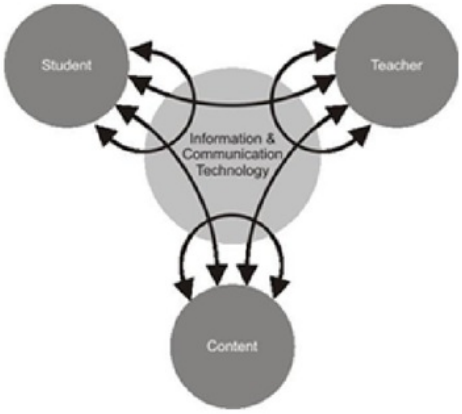


Table 1. Examples of ICT Implementation in Relaying the Interaction among E-Learning Elements

No.	Relation	Examples
1	student-student	chat, forum, email
2	student-content	download, search, view, create
3	student- teacher	chat, forum, email
4	teacher-teacher	chat, forum, email
5	teacher-content	upload, view, create
6	content-content	link files, indexing

A Learning Management System (LMS) efficiently establishes and facilitates an e-learning process. LMS is "an information system that administers instructor-led and e-learning courses and keeps track of the student's progress" (Brown & Johnson, 2003). LMS simplifies the efforts in the training, evaluation, and tracking of students in their academic experience and performances.

MOODLE as an Integrated LMS

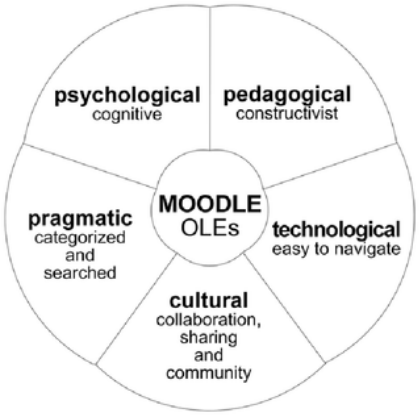
Modular Object-Oriented Dynamic Learning Environment (MOODLE) is an open-source Course Management System (CMS), also known as an LMS or a Virtual Learning Environment (VLE) (Moodle Inc., 2010). As an open-source application, MOODLE is built with PHP and MySQL (Se , Balasubramanian, & Manohar, 2008) and can be installed in a Windows platform. Additionally, it includes Linux (www.linux.com) as the operating system, Zope (www.zope.org) as the application server, Python (www.python.org) as a lower-level programming environment, Apache (www.apache.org) as the web server gateway, and a number of Unix shell scripts to control the system (Dougiamas, 2000).

Shweta and Shri Ram (2009) state that MOODLE is an e-learning tool that could offer simple and safe solutions to any segment of an institution, be it small-scale (such as an individual teacher) or large-scale (such as an entire faculty of a university). Furthermore, MOODLE facilitates online collaborations, which can involve teacher-to-student, teacher-to-teacher, or student-to-student interactions (Shweta & Shri Ram, 2009).

MOODLE's function as a developer of constructivist (student-centered learning) environments (giamas & Taylor, 2003) is examined by Antonenko, Toy, and Niederhauser (2005) through the use of framework developed by Hannafin and Land (1997). The framework consists of five components: psychological,

pedagogical, technological, cultural, and pragmatic. Figure 2 highlights the five components of these core foundations as applied to the design of student-centered learning environments.

Figure 2. Framework of MOODLE in Building Student-Centered Learning Environments



E-learning for High School

It is generally suggested that e-learning ought to be implemented in almost every high school setting (Vecchio & & Loughney, 2006; Cavanaugh, Gillian, Kromrey, Hess, & Blomeyer, 2004; Solomon, 2005). In the United States, there is a widespread implementation of e-learning within the K-12 level. According to the US Department of Education's National Education Technology Plan, "[a]t least 15 states provide some form of virtual schooling to supplement regular classes or to provide for the special needs. Hundreds of thousands of students are taking advantage of e-learning [during] this school year. About 25 percent of all K-12 public schools now offer some form of e-learning or virtual school instruction." (US Department of Education, 2004).

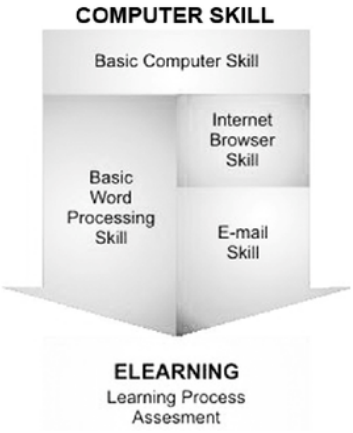
The majority of high schools in Indonesia are yet to accomplish this level of e-learning ubiquity. Each student is accustomed to attending classes regularly during a specific time period. Therefore, a less drastic measure was taken for e-learning implementation; i.e. its parallel incorporation with regular, traditional classroom instructional sessions (Edler, 2006).

Students' Computer Skill

As a prerequisite, each student must have basic computer skills (the knowledge on how to use modern ICT and computer) to participare in an e-learning system (Nedelko, 2008). Some researchers have studied the computer skills itself, e.g. Madigan, Goodfellow, and Stone (2007), who identify that a set of computer skills has five constructs: basic computer operation, electronic communication, word processing and spreadsheet, presentation software, and information retrieval and research.

Vecchio and Loughney (2006) state that in order to succeed in e-learning, participating students need to have the computer skills to operate programs for word processing, Internet browsing, and e-mailing because Internet browser, e-mail, and basic word processing software are the application's software layer, e.g. Windows, Macintosh, or Linux. Students need the Internet browser ability for communication via email address, which subsequently involves email management. The relationships between different computer skills and e-learning are mapped in Figure 3.

Figure 3. Framework of the Relationship between Computer Skill and E-learning



METHOD

This study was a non-experimental quantitative research. It involved collecting data to determine the existence and extent of a relationship between a tenth-grade student's computer skill and the student's achievement in the IT course, which was conducted through LMS. Furthermore, an analysis was also conducted in order to determine if there were any differences in the students' computer skills and their achievement before and after the e-learning implementation. Analyses were also performed based on the students' demographic data, which consisted of gender, religion, socioeconomic status, entrance exam result, verbal skills, logic skills, and arithmetic skills.

The e-learning system was implemented at a private high school during the first semester of the 2011-2012 academic year. This study used convenience sample with non-probabilistic sampling technique. A probabilistic sample was not necessary for this research since all students enrolled in the IT course participated in the study, totaling to 182 students.

Instrument And Data Collection

A test called the Technical Survival Skill Test (TSST) was used to determine the students' computer skill levels in the form of numerical scores. TSST was developed by the Ontario Institute for Studies in Education (OISE) and the University of Toronto (OISE University of Toronto, 2007). It was used by the OISE as a prerequisite for e-learning system at University of Toronto. A similar type of test was also used by the North Seattle Community Colleges (Washington State Board for Community and Technical Colleges, 2010), University of Michigan (University of Michigan: School of Dentistry, 2009), and other online educational institutions.

TSST consists of four segments that measure desktop computer skills, Internet browsing skills, e-mail - portal skills, and basic word-processing skills. The reliability of this instrument within the students in high school was determined before more in-depth analyses were done. TSST was administered to the sample on one occasion. The internal consistency was measured with Cronbach's alpha technique.

The students' achievement scores were obtained through their average scores from all assignments that they had completed during the first semester. The assignments were design by the IT teachers according to the standards established by the Indonesian Department of Education, written in the *Kurikulum Tingkat Satuan Pelajaran* (KTSP); it was a curriculum implemented by all national schools in Indonesia (Kementrian Komunikasi dan Informatika Republik Indonesia, 2007). The assignments consisted of tasks and quizzes that were developed to measure the students' mastery of course materials. This measuring technique had fulfilled the face validity, content validity, and construct validity. According to Bordens and Abbot (2008), the three types of validity requirements can gurantee the accuracy of a measurement. It was arguable that the students' achievement measuring technique was accurate.

Data Analysis

This study analyzed two main variables: the students' achievement as the dependent variable and the students' computer skills as the independent variable. Analytical methods used were correlation analysis and regression analysis. Pearson's correlation analysis was used to determine the degree of correlation since there were more than 30 participants in the study. Pearson's correlation reflected the degree of linear relationship between the two variables. The regression analysis used in this study was the linear regression analysis. The regression equation was formulated and could be used to predict the value of dependent variable if the independent variable's value was given. The correlation and regression analyses were used based on the assumption that there were no difference in the students' computer skill and students' achievement based on their demographic data. If there were differences, ANCOVA analysis would be performed to account for all covariates involved.

RESULTS AND DISCUSSION

Based on the TSST's Cronbach's alpha score analysis, the Cronbach's alpha score for 40 items in TSST was 0.923. A Cronbach's alpha score greater than 0.600 was considered to have a high level of reliability (Priyatno, 2009). Based on this, the TSST had a high reliability level in measuring the computer skills of high school students.

The main result of this study concluded that the students' computer skill had a direct correlation with the students' achievement through the use of learning management system for information technology subject among grade ten students. The correlation was significantly strong ($r(172) = 0.896$, $p < 0.05$). Moreover, the result also found that all of the computer skill sub-scores had significantly strong correlation with the students' performance. From the correlation analysis between the students' computer skill sub-scores and the students' academic achievement, the study found that Basic Word-Processing Skill scores had the lowest significant correlation ($r(172) = 0.624$, $p < 0.05$), while the Internet Browsing Skill had the highest significant correlation ($r(172) = 0.866$, $p < 0.05$), relative to other computer skill sub-scores. These results were in-line with previous studies that found students who participated in e-learning must possess computer skills in order to be successful in e-learning (Taynton, 2000; Cavanaugh, Gillian, Kromrey, Hess, & Blomeyer, 2004; Clarke, Ayres, & Sweller, 2005; Vecchio & & Loughney, 2006; Australian Flexible Learning Framework, 2007; Saadé, Kira, & Dogmoch, 2007; Nedelko, 2008; Shweta & Shri Ram, 2009; Tsai, 2009). Taynton (2000) observes that students in Southern Cross University required support in developing computer literacy for an effective online participation. From another study, Tsai (2009) finds that Internet literacy was important in measuring the Online Learning Strategies Scale.

The results of this study also showed that computer skill scores differed by gender. The female's mean scores of computer skill and student's achievement were significantly higher than those of the male students ($t(172) = 2.147$, $p < .05$ and $t(182) = 2.970$, $p < .05$). It was reported that female students enjoyed the e-learning experience more than the male students did (Boulton, 2008). Although females had a higher potential to excel in the IT field, their interest in pursuing IT as a career was low (Davies, Klawe, Ng, Nyhus, & Sullivan, 2003; Reding, 2007). Davies, Kalwe, Ng, Nyhus, and Sullivan (2003) identify the major causes for this phenomenon, such as gender-bias socialization, lack of access and experience in computers, negative attitudes, and low perceived ability career. The low interest might also be caused by computer anxiety. Saadé, Kira, & Dogmoch (2007) points out that female population scored at the high-end of the computer anxiety spectrum. This result differs from others that discussed gender issues within the context of ICT. Faekah (2005) discovers that female students are still lacking in terms of computer skills. However, severalr studies' findings state that both male and female students had approximately the same level of actual ICT skills (Kay, 2006; Madigan, Goodfellow, & A. Stone, 2007).

Additionally, the results also showed that there was a significant difference in the mean scores based on the father's education level, ($t(170) = -2.448$, $p < .05$). Indonesia is a country that adopts paternalism as stated by the Ministry of Communications and Information Technology of the Republic Indonesia's website [38]. Male parent typically becomes the leader in the family and has an influence on the availability of computers in the family. Furthermore, some studies observe that parents have a major influence on computer ability (Galpin, Sanders, Turner, & Venter, 2003; Sanders, 2005). Further analysis showed that the father's level of education affected the students' computer skills. Students whose fathers completed a Bachelor's degree or beyond have a higher mean of computer skill scores compared to those whose fathers completed an education level below Bachelor's.

This study also found that students' verbal abilities and entrance exam scores for English correlated with their computer skills. Verbal ability is a psychological variable used to explain why vocabulary scores correlate with verbal analogies that lead to the determination of semantics, allowing for the logical deduction of relationships between word pairs (Carey, 2000). In e-learning, commands and tasks are given by teachers to students in

writing and in this case, mainly in English. Students needed the verbal ability to interpret the instruction given by the teacher and to work with computer (Karsten & Roth, 1998; Gugerty, Treadaway, & Rubinstein, 2006; Akkar, 2007). In line with the study by Gugerty, Treadaway, and Rubinstein (2006), this study also found that verbal ability had the highest correlation with Internet browser skills compared to other computer skill sub-scores because verbal ability had a direct influence on searching ability.

The TSST is a test that was constructed to measure the skills needed by students in order to keep up with an e-learning process. This study found that abstract logic did not correlate with computer skills that were measured by the TSST. Thus, in order to adapt to the e-learning process, students did not require a prominent logic ability. Nevertheless, logic ability does correlate with other computer skill indicators, especially in computer programming skills (McMahon, 2009).

The groups in grade 10 study subjects equitably distributed based on students' abilities. For a school considering e-learning implementation, the level of computer skills should be considered when placing students into groups. This is necessary since students' computer skill correlates with their achievement in through e-learning. For this study's subjects, the standard score of mastery learning outcomes (*Ketuntasan Hasil Belajar*) is 70 for IT subject. In order to attain this score, based on the regression equality, a student should have a computer skill score of at least 68.23.

This study produced key points that should be considered before and during the implementation of e-learning. The result of measuring the relationship between students' computer skill and students' achievement could be used to assist in the strategy development for e-learning implementation. Some suggestions are as follows:

a) Student Admission Process

This study showed that the students' computer skills had a strong correlation with their achievements. Therefore, it is important to consider the influence of computer skills on achievement when implementing ICT into the learning process. A computer skills test should be designed and administered as a part of the student admissions requirements. The test should be taken prior to the students' participation in an e-learning process. Furthermore, the school that implements an e-learning should consider students' computer skills when dividing the students into groups based on students' abilities.

b) Enrollment and Course Management Process

This study concluded that proficiency in e-mailing skills is one of the four computer skills that students should possess in order to keep up with e-learning. Students need to have the ability to manage their email accounts before they log into an e-learning portal for the first time, especially since the administrator sends the username and initial password through email.

c) Learning Process

The suggested type of e-learning for the high school level is the combined model. This model allows teacher and student to meet (offline) in a class. The e-learning can be delivered using MOODLE as an LMS.

d) Assessment Process

In a combined model, there is an online and offline component to the learning process. The assignments can be done online and/or offline. The final score is an average score of all the online and offline assignments.

CONCLUSIONS

Revealing the basic foundation of e-learning implementation is necessary in order to maximize the learning process. This can be achieved by examining all aspects related to education and technology. This is in line with Honey, Culp, and Spielvogel (2005) who state that there is a correlation between technology and students' achievement. In fact, students' achievement measurements are not solely based on cognitive scores (Honey, Culp, & Spielvogel, 2005). There are other scores that must be taken into consideration, such as the psychomotor and affective scores. These two variables are related to the achievement scores and can be examined further.

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