

A Meta-Analysis of the Relationship between E-Learning and Students' Academic Achievement in Higher Education

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Abstract

E-learning is substantially becoming a popular effective learning approach within greater academic settings due to high use of web systems in learning. E-learning involves utilization of information and communication technology (ICT) to improve and help teaching and learning. The aim of this study was to estimate the relationship between e-learning and students' academic achievement in higher education. Based on systematic sampling approach, a sample of 15 research studies conducted between 2010 and 2013 were used in computation of results using the Cohen's model. The computed results ($r = 0.782$) indicate that ICT has a statistically significant positive impact on e-learning based students' academic achievements. The findings indicate that ICT has a significant positive impact on students' educational overall academic achievements.

Keywords: E-learning, information and communication technology (ICT), students' academic achievement

1. INTRODUCTION

E-learning (EL) basically involves use and application of information and communication technologies (ICT) at web sites, personal computers (PCs), tablet PCs, cell phones, learning management system (LMS), televisions (TVs), radios and other means to improve teaching and learning processes. E-learning is really a unifying phrase accustomed to explain the areas associated with the internet, web-based instruction and technologies directions (Oye, Salleh & Iahad, 2010:24). In that respect, e-learning is substantially becoming a learning strategy in the realm of teaching for learning, skills training and development and many corporate functions as evidenced by massive development of web technologies.

Nonetheless, many academic and corporate skills training institutions are today making significant strides towards use of more interactive e-learning strategies to effectively enhance overall performance of college students and their employees. In many developed economies, several academic institutions make use of extremely interactive e-learning that directly enhances students' performance (Soleymanpour, Khalkhali & Reayatkoonandeh, and 2010:83). In the recent era, technologies have indeed become devices accustomed to get rid of physical obstacles and allow students to learn at anytime and anywhere without having physical interaction with the instructor or lecturer. Against this background, e-Learning therefore improves easy access to effective teaching and learning, and thus enhancing students' academic efficiency.

According to Heeger (2010:8), e-learning enables numerous higher education students to take similar programs concurrently. Nowadays, educational systems have grown to enjoy the reasonable instructions in addition to learning and have to end up being through college campuses. Research findings by Holley (2012:118) indicate that e-learning systems permit instruction method geared to improve top quality related to instruction and higher education students' academic achievement. Soleymanpour, Khalkhali and Reayatkoonandeh (2010:87) further elaborate that those higher education students from tertiary academic institutions that have demonstrated remarkable use of e-learning generally perform quite much better than student counterparts who much rely on use of face-to-face communications and physical interactions with their instructors.

Holley (2012:117) also reports that university students who generally participate in online or e-learning achieve far better amounts compared to university students who examined traditional methods. Due to emergence of advancements in educational technology, e-learning is currently gaining substantial attention in education and for this reason; several higher educational institutions are now pursuing application of electronic learning programs. As such, e-learning is continuously becoming well-established in a number of both private and public higher education institutions in the world nowadays. Most of these higher education institutions have become aware of the impacts related to e-learning on students' academic achievement. From a general standpoint, the commonly known e-learning facilities include three elements; namely convenience for individual paperwork, automatic conformity, and conformity (Cooke, 2014:11).

2. LITERATURE REVIEW

E-learning describes using information and communication technology (ICT) towards improving learning within educational training. Nevertheless, e-learning involves use and application of a variety of tools and techniques, for instance e-mails, websites, blogs, social and business media, and being able to access program supplies on the internet whilst carrying out programs delivered entirely on the internet (Heeger, 2010:10). Although e-learning platforms can be of different kinds, higher academic institutions provide educational programs that

involve use of web or the internet systems to improve students' academic achievements (Lorraine, 2010:22). Following Oye, Salleh & Iahad (2011:45), e-learning is basically a teaching and learning method via the web, system or a standalone personal computer (PC). From another dimension, Cooke (2014:8) defines e-learning as a network-enabled expression associated with functions that facilitate teaching and learning in an efficient manner. E-learning programs and procedures consist of web-based learning, computer-based learning, digital classes and electronic activity (Heeger, 2010:7). The programs provide platforms with content materials which are transferred by the web intranet or extranet, sound or even movie MP3s, satellite televisions and CD-ROMs. It is against this background that e-learning was initially known as "internet-based learning", while nowadays, e-learning is called "web-based learning". Technically, e-learning does not only regard instructions and coaching by the instructor, but also involves learning that is tailored made to specific learner needs. According to Oye, Salleh and Iahad (2011:47), numerous terminologies occur to be accustomed to determine learning which are on the internet. For that reason, e-learning and learning online are regarded to have different meanings (Cooke, 2014:8).

Given that the success of e-learning in enhancing students' academic achievement depends on the quality of information and communication technology (ICT), the impact of e-learning on student academic achievement cannot be isolated from the nature ICT infrastructure (Niyazazari & Hosseini, 2012:113). In today's highly globalised world, the use and application of information and communication technology (ICT) in teaching for learning has brought about remarkable achievement in improving students' academic performance in many academic disciplines and faculties (Zameni, Nasimi, Rezayirad & Ghanbarpoor, 2011:82). Najafi (2012:38) further confirms that the increasing use of advanced multi-media information and communication technologies in teaching and learning processes clearly indicates that the effectiveness of ICT in teaching and learning systems. According to Mahdinejad & Amoi (2011:114), application of ICT-based teaching and learning in an interactive manner stimulates students' interests to acquire knowledge and apply the acquired knowledge in solving practical life social and economic problems.

The use of information and communication technology (ICT); which comprises of desktop and personal computers (PCs), laptops, the internet, and multimedia, enhances capacity to accomplish tasks faster with speed and accuracy in teaching and learning. These features change the role of the teacher and the learner, facilitate learning, and lead to interactive learning, learner autonomy, self-sufficiency, and self-confidence (Zameni & Kardan, 2012:26). By integrating content and information literacy, often in textual and visual forms, ICT produces significant learning and academic achievement. In other words, incorporation of ICT into the area of education has changed the role of teachers from a mere source of educational material to supervision of learning process. This increases self-sufficiency and self-confidence in students' learning processes (Zameni et al., 2012:82).

The knowledge of ICT today is being emphasized as the effective vehicle for teaching and learning (Zameni & Karan, 2011:25). With the widespread use of the internet, knowledge has become more effectively reachable by the mass population of students. The use of ICT promotes effective engagement of the learners, enhancement of learning, ease the use of teaching methods and materials to respond to students' interests and needs; empowerment of the learners to control the learning schedule, and the pace of execution of the learning program; enables interactions between learners and materials, and learners and teachers by the usage of animation, image and sound together in the learning process; abstract concepts that are difficult to understand can be solid and easy to learn by eliminating the limitations of conventional method of teaching and the constraints of time and space (Qaznavi, 2010:46).

The study conducted by Mahdinejad and Amoi (2011:108) on tertiary educational institutions reveals that 54.2% of the colleges lack well equipped computer laboratories. Consequently, many colleges could not meet the ICT facilities required for effective curriculum delivery. This implied that only few colleges could achieve quality assurance in teaching and learning processes. This situation would no doubt cause students' low academic achievements. Hence, the needs to further analyze the adequacy, utilization and maintenance of ICT facilities with a view to advising stakeholders in higher education sector to improve on provision, capacity utilization and sustenance of ICT facilities in higher education colleges (Mahdinejad & Amoi (2011:112).

Shekari (2010:78) further finds relatively low usage of ICT facilities (46%) in teaching and learning processes in higher education colleges as both teachers and students are constrained by inadequate ICT facilities to advance teaching and learning. This implies that teachers and students would have limited opportunities and capability in using ICT facilities to expand their knowledge and skills in curriculum instruction. Consequently the quality of education being given to learners would be inadequate and reflect in low outcome. The major constraints perceived by teachers against effective utilization of ICT facilities for teaching-learning process tertiary education institutions include inadequate supply of computer hardware and software; irregular power supply; limited training opportunities for teachers; low level of institutional partnership with professional and corporate bodies for technical support; poor funding and maintenance (Shekari, 2010:82). The challenges identified are inimical to effective teaching and learning processes; consequently, majority of the learners lack

the knowledge of ICT in colleges. Adequate provision of ICT facilities and better management of available ICT facilities were identified as means to improve ICT facilities utilization in tertiary colleges in order to enhance students' academic performance (Mahdinejad and Amooi, 2011:11).

3. METHODOLOGY

This section provides the analytical framework and statistical model applied in the analysis.

3.1 Statistical Model

In an endeavour to address the inconsistency between the relationship of e-learning and students' academic achievement, this study used a meta-analysis methodology to provide new insights into the respective relationship. Meta-analysis focuses on combining the results of different studies in order to determine new relationships that cannot be otherwise obtained. Following Khalkhali, Shakibayi and Andosh (2011:17), some studies on e-learning and its impact on students' academic achievement report the significance of the relationships, but do not provide evidence about the size effect to which it impacts on academic achievement. The methodological approach applied in this study therefore determines the significance of the impact of e-learning on academic achievement and the size of the impact of e-learning on academic achievement.

The statistical rationale behind application of a meta-analysis methodology was to compute the mean effect size (Jamali, Abedi, Faramarzi, & Aghayi, 2012:28). Data on the study was collated from 15 documents from relevant research studies conducted on the effect of ICT based e-learning on academic achievement during 2010-2012. The documents were selected using systematic sampling. Effect size, fixed and random effects meta-analysis models were used for data analysis; and the Cohen's model was applied to interpret the results.

4. RESULTS AND ANALYSIS

The effect sizes were first individually estimated in order to compute combined mixed and random effects presented in Table 4.1 and Table 4.2 below.

Table 4.1: Meta-Analysis of the Impact of E-learning and academic achievement

	n	Fixed Effects	Random Effects	Explained Variance	Confidence Interval (95%)	Homogeneity Test	df	Sig.
E-learning and students' academic achievement	15	0.712	0.712	0.128	0.472 0.718	0.747*	4	0.031

Based on the results presented in Table 4.1 above, the random effects mean size of the impact of e-learning on students' academic achievement in the studied sample was 0.712. Given that the estimated impact size lies within the confidence interval, therefore e-learning has a significant effect on students' academic achievement in higher education. The homogeneity test also provided significant values for the effect of e-learning on academic achievement. Results on the Cohen's model used to interpret the effect size was computed and provided in Table 4.2 below.

Table 4.2: Effect Size Data Based on Cohen's model

Effect Size	Correlation Coefficient (r)	Cohen's d	Explained Variance
Small	0.3	0.4	0.02
Medium	0.5	0.7	0.13
Large	0.6	0.9	0.48

The results provided on the Cohen's model indicate that the calculated effect size stands above the average level based on the Cohen's model. Therefore, it can statistically well be inferred that e-learning has a significant positive impact or effect on students' academic performance. In the present knowledge era, ICT has been very effective for the advancement of societies, especially in terms of learning and education. Based on this study, the meta-analysis of effect sizes reported in fifteen research papers indicates that there e-learning has a significant positive impact on students' academic achievement with a mean effect size of 0.712. Given that the mean effect size lies within the confidence interval, the significant positive impact of e-learning on academic achievement can therefore be confirmed.

Moreover, the mean effect size ($= 0.6$) based on the Cohen's model stands slightly above the average. Therefore, it can be confirmed that e-learning has a statistically significant moderate positive effect on students' academic achievement. From a practical perspective, the significance of ICT in enhancing use of e-learning remains an important factor in the field of higher education teaching and learning as it fosters and improves learning. Considering the effect size of 0.712, it can statistically be inferred that provision of adequate ICT infrastructure towards facilitating use of e-learning can substantially lead improved learning and students' academic achievement. Additionally, e-learning can therefore enable students to demonstrate their capabilities and skills quite much faster as a result of availability and application of alternative methods of learning. As ICT integrates content and information literacy often in textual and visual forms, it further enhances significant learning and academic achievement. Therefore, higher educational institutions should realise the importance of use of e-learning in teaching and learning processes.

5. CONCLUSION AND RECOMMENDATIONS

E-learning has dominantly become an effective mechanism in professional training as well as teaching and learning at tertiary level due to its speed, convenience and efficiency in accessing and processing information via web systems. This research primarily focused on analyzing the relationship between e-learning and students' academic achievement. The results derived from the meta-analysis reveal that use of in associated information and communication technology for enhancing e-learning enhances students' educational academic achievement. The results therefore indicate that effective application in use of ICT tools to facilitate e-learning is an effective tool towards enhancing students' overall academic achievement in their learning. Undoubtedly, the most important argument is that use of e-learning possess substantial positive impact on e-learning; and hence students' academic achievements. For purposes of further research on this subject, future research should therefore focus on examining the relationship between the extent to which use of ICT tools in form of e-learning in classroom set-ups directly influences students' overall academic achievement rather than focusing on individual subjects.

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