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The empirical study on the impact of student-centered learning application to cognition and social learning

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Abstract. Cognition is the umbrella term for learning skills-it is the ability to relate and comprehend what was learned. Whereas social learning is the ability of learner to grasp ideas shared by others and from a community of shared knowledge resources. The main objective of this study was to explore the impact of technology-mediated learning to the cognitive thinking of learners in terms of their ability to understand computer-assisted instructions, adopt new knowledge and apply mental activities and skills to perform reasoning and grasp what is being taught using the Student-Centered Learning Software (SCLS). Also, it aims to understand the impact of technology-mediated learning to social learning in terms of learner's ability to learn and perform activities with peers or in a group-related work. Experimental research was applied and a pre-tested questionnaire was used for data collection from 300 tertiary learners in 2 private universities in the Philippines. Using one-way ANOVA and regression analysis, study has revealed that with lower limit of 95% confidence level, the learner's frequency of use, time spent in taking activity and their level of understanding and comprehension have significant difference to their cognition where $p=0.000<0.05$. Whereas using T-test, learner's engagement to peer and group related activities has significant difference of $pvalue<0.05$ and variance=0.20 to their social learning. Thus, integration of SCLS may positively uphold active learning, increase cognitive thinking, stimulate enthusiasm and social learning. Hence, learner's interactivity to computer mediated technology may lead to a productive learning process.

1. Introduction

Information and communication technologies (ICT) have transformed lives and reshaped the nature of everyday activities and contemporary times as it plays important role in our lifestyle [1] and [2] collectively state that education is becoming an abundant service delivered anywhere and anytime over the world, the higher education institutions promotes the implementation of e-learning in traditional course delivery to prepare their learners and institution for the future participation in new educational evolution. This is why e-learning has become an important means of gaining knowledge with the help of electronic media, typically on the Internet [3].

E-Learning is a technology known as web-based learning, online learning, distributed learning, computer-assisted instruction or Internet-based learning. It is primarily a web-based system of education that makes information or knowledge available to users or learners [4] [5]. The strongest



argument of E-learning for distance education is its potential to provide instruction to learners who, because of distance, time, or financial constraints, do not have access to traditional learning opportunities or specialized courses. Distance education, in which the teacher and learners are separated in place and/or time, may be able to provide access for them. It also mentioned that e-learning can help lecturers to save time and effort [6]. Many studies have established proofs about the viability of e-learning as a means for distance education. A research study results show that most of learners who were exposed to e-learning preferred to learn via e-learning because it provides them greater flexibility to learn at any time and any place [7]. Similarly, it was conceded in the Philippines that the design for a good formula to suit the Filipino preference would open the opportunity for growth of e-learning in the country that large organizations such as universities, big communities, large and medium-sized businesses. It could enhance the efficacy of knowledge and qualifications via ease of access to a huge amount of information and reduce their training costs [8]. Consequently, today's modern classroom, whether online or campus-based, uses e-learning tools and Learning Management Systems (LMS) which aimed to facilitate cognitive process and improve student's performance on classroom activities [9]. Thus, majority of higher educational institutions in the Philippines already embraces LMS. However, a successful e-learning system should consider different factors such as personal, social, cultural, technological, organizational and environmental because the success implementation of e-learning tool depends of student's adaptability and gratification [10].

1.1 The Role of e-learning in improving cognitive thinking

Studies associated to online learning have begun to turn its focus to better explore the unique needs associated to online learners including their ability to perform online learning, understand what is being taught using e-learning, understand distributed learning, and use computer-assisted instruction or internet-based learning in adopting new knowledge [11]. Among the significant role of e-learning according to recent studies is its positive impact to improving the cognitive thinking of individuals. Cognitive thinking is referred to as the process of using mental activities and skills to accomplish tasks such as learning, reasoning, understanding, remembering, and paying attention [12]. As to cognition, it refers to process of acquiring knowledge and understanding through thought, experience, and the senses [13]. Further, it was also verified that the actual use of e-learning has significant effect on student's academic performance while attitudes have influence on intention to use it. Similarly, [14] as per study with chemistry learners, e-learning is effective for knowledge and creativity acquisitions and the greater e-learning opportunities should be provided for a wider audience. While [15] has recently discovered that learner's employs variety of learning strategies in cognitive learning to be able for them to complete their coursework in a semester. Whilst, time management was recorded as the learner's primary cognitive learning strategy. Aforementioned studies only prove that finding out the impact of e-learning to the cognitive thinking of learners is a need. Therefore, following the initial studies on cognitive presence, as defined by [16], cognitive presence is the ability of participants in any particular pattern of Community of Inquiry (COI) to conceptualize a meaning through persistent communication. Additionally, [17] confirms that in the works and idea of John Dewey, the two sides of education concerns about psychological and social sides. Hence, collaborative reconstruction of experience has a deep essence in education because practical inquiry model operationalizes cognitive presence in the COI. Consequently, [18] also attest that social cognitive view of self-regulated learning has positive impact to learners who uses online learning environment wherein learners who embraces high level of motivation employs better learning strategies and react appropriately to environmental influences such as activity feedback. Since social learning was also discovered to have an association with cognitive learning, [19] [20] conforms that peer, teacher's collaboration and encouragement of families contributes a lot to the cognitive learning of learners.

1.2 Social Learning and student's engagement

Social interaction is one of the main focus and objective of e-learning. In addition, [21] mentioned that in the actual process of learning, the most active factor is the learner. When the E-learning application

is well designed and specifically suited to a type of learners, enhancements in learning most specially using technology gives learners the opportunity to interact and become more engaged [22]. Further studies also confirmed that e-learning promotes a learner-centred instructional strategy that allows the learners to do independent explorations of a given topic [23]. Thus, e-learning developments should take high consideration of the learner's ability to acquire the required and needed knowledge. To achieve this, appropriate pedagogical and didactical approaches is the key aspects of all e-learning technology [24]. Moreover, [25] mentioned that inquiry-based learning is a pedagogical approach that enables the learners to develop critical thinking through social interaction. Likewise, [16] said that the role of interaction in an online learning environment does not only refer to student-student interaction but also interaction with the teachers and even with the content.

1.3 Research Objectives

The objective of the research was to uncover the impact of a developed e-learning tool to learner's cognition and social learning. Specifically, the study focuses on utilizing a student-centered learning environment that will be used to cross examine the student's profiles such as engagement in e-learning, frequency of use, time spent in doing learning activities, and the student's comprehension level. These factors shall then be used to determine whether the participant's profiles in using e-learning has a significant relationship to the impact of utilizing technology in cognition and social learning

2. Methodology

Experiment was conducted within three (3) weeks during June to July 2018 to get students assessment result in using the SCLS and a pre-tested questionnaire which was reviewed and approved by the Institutional Review Board (IRB) of University of the Cordilleras, Philippines with an adaptation of Cognitive Presence Scale [21] and Social Skills Rating System [22] from ASPECT [23] was used for data collection. The data was collected from freshmen learners in two (2) private universities in the Philippines, i.e PHINMA-University of Pangasinan (UPang) and PHINMA-UPang College Urdaneta. The non-probability purposive sampling technique was used and the learners were approached during their class break to fill-in online survey. A total of 300 questionnaires were distributed and 271 filled-in useable questionnaires were received back resulting in a response rate of 90.33%. One-way ANOVA, regression analysis and T-test were used to analyze the significant difference between the variables.

2.1. The e-learning tool

In the course of the study, the researchers utilized SCLS which was used by teachers and learners in Information Technology Education (ITE) subjects of PHINMA-University of Pangasinan. SCLS is an online application developed by IT faculty members to promote active learning [9] and is being used by 5 universities among PHINMA Education Network. SCLS has 3 user level: Admin, Teacher and Student. The admin account has the overall control over the system including module contents; Teacher's account is capable of adding student's list, view learners' scores, activate module and activities, and manually check essay-types questions; students can view activated modules, can answer activities, quizzes and view scoreboards and badges. Figure 1 shows the user's interface of student's account. Contemplating to the percentage on student's engagement to the use of e-learning application [26], it was discovered that the integration of e-learning application like SCLS in private universities was to promote active learning where student learn by applying what they have learned based from a given concept notes and guided activities. This is the reason why SCLS was designed to have 8 components: learning objectives, review lessons, concept notes, developmental activity, guided practice, independent activity, closure activity and enrichment activity. The first five (5) modules mentioned were to support student's comprehension to the topic matter. Independent and closure activities were to be graded by the system or the teacher; these modules pertain to the assessment of the student's learning. Lastly, enrichment activity is a supplementary module for the teacher to create

strategies to improve student's learning through the SCLS. Figure 2 shows the user interface for learners as to taking up of quizzes and activities.

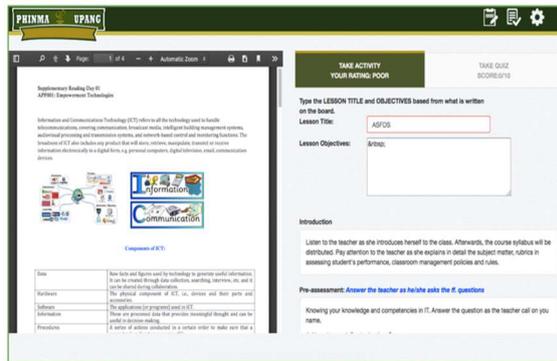


Figure 1. Student's account page to take activity

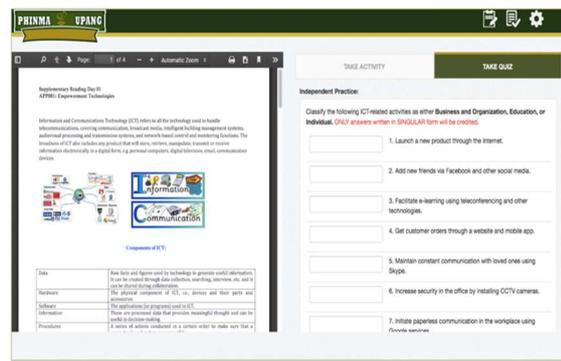


Figure 2. User interface for student to take quiz

3. Discussion

A response rate of 90.33% (N=271) was obtained from 300 participants. Among 5 PHINMA Education Network, 2 institutions participated in the study wherein 64.21% of them came from PHINMA-University of Pangasinan and 35.79% were from PHINMA-UPang College of Urdaneta. There was almost an equal distribution of participants to gender 49.82% male and 50.18% female. As to nationality, there were N=269 Filipinos, N=1 Filipino-Chinese, and N=1 Filipino-American.

3.1. Student's engagement to e-learning and their frequency of use

Student's engagement from their previous schooling was collected to understand their exposure to e-learning prior to the use of SCLS in 2 universities. Noticeably, it was found out that 67.16% learners had never experienced e-learning from their previous year of study because they were enrolled in public school where their learning materials and facilities were limited to pen/chalk and board and while 32.84% who went for schooling in private school had experienced e-learning tool where technological innovation is positively embraced to better improve their quality education. Surprisingly, learner's exposure to e-learning has evidently increased to 70.85% where 36.16% of them used e-learning applications in their major subjects in an ITE course and 34.69% used e-learning tools in minor subjects when enrolled in college. Also, student's engagement to SCLS, was further attested by getting the frequency of their exposure to the learning system. Wherein 39.85% of learners use the SCLS twice a week. This supports the teacher's implementation of active learning, which suffice that the teacher requires the learners to access the SCLS for the distribution of concept notes and supplementary reading. Whereas 22.14% among respondents uses SCLS once a week for the purpose of downloading the lecture notes, supplementary reading and submitting the given activities online. Amongst 21.40% learners occasionally access the SCLS only when prescribed by teachers. Thus, student's engagement and exposure to technology-mediated learning maybe influenced by teacher's initiative and teaching strategy. Further, learners were asked a Likert-type of question to understand their engagement to SCLS. Table 1 shows the factors that influence learners to engage in technology-mediated learning.

3.2. Student's understanding and comprehension vs. time spent in assessment

Analysis has revealed that 61.62% (N=167) of 271 respondents consumes ≥ 1 hour in taking the activity. It was found out that with 4 different activities namely (a) review lesson, (b) developmental practice, (c) guided practice and (d) independent activity, student spends more time in reading and understanding the concepts notes and instructions so as for them to independently answer the questions and perform hands-on activities in independent activity section. Whilst, 29.15% (N=79) spent 31-59 minutes in doing the same set of activities and 9.23% (N=25) spent ≤ 30 mins in doing the

activity. It was also discovered that learners who consumes less than an hour in taking the activity have already experienced using e-learning tool even before coming to college.

Table 1. Factors influencing learners to be engaged in technology-mediated learning

Statements	(TCS)	SCLS
a. I was given the opportunity to review notes from time to time.	48.71%	51.29%
b. I can finish the activity within a given period of time.	37.64%	62.36%
c. Topics are better understood when supported by digital resources and examples.	27.68%	72.32%
d. I don't need to repeatedly approach the teacher if I was not able to understand the instructions and the concept notes.	42.07%	57.93%
e. I can easily absorb the idea and create new knowledge.	43.54%	56.46%
f. It allows me to collaborate with my peers if I need to get additional knowledge.	39.11%	60.89%
g. It allows me to perform creative imagination while reading the concept notes because I can clearly understand each sentence.	35.79%	64.21%
h. It gives me ample time to think critically and logically.	39.48%	60.52%
i. I can think and work independently.	36.90%	63.10%
j. I am properly guided thus I was able to develop new knowledge.	38.38%	61.62%
k. I immediately get feedback and result to my quiz/activity.	29.52%	70.48%

A Likert-type of question was asked to assess their understanding and comprehension. Analysis has revealed that learners who consumed more than an hour in taking the activity, with weighted mean (WM=3.43) learners were able to explain, (WM =3.24) discuss, and (WM =3.47) briefly summarize independently what they have learned in the class through the use of SCLS. This can be supported via their responses on the (WM =3.97) content of the module where N=147 of them agreed that the content is what they really expected to learn; N=117 (WM =3.58) agreed that the content of concept notes is good enough to represent what they have learned in the class in a form of graphs and diagram and with that, they were able to reorganize (N=132 and WM =3.66) and outline (N=112 and WM =3.51) all the topics.

As to student's level of constructing knowledge, learners who spends ≥ 1 hour in taking the activity, N=145 with WM =3.94 felt that they were actively learning in the class because with WM =3.91 they were able to excellently do their assignment and (WM =3.9) apply in real world through hands-on activity what they have learned. With that, getting new perspective (N=140; WM =3.80) and in-depth understanding (N=117; WM =3.62) is what learners value when assessing their level of constructing their knowledge similar to the study of [27]. Using an existing tool named as Cognitive Presence Scale for measuring student's involvement [21], student's level of understanding was analyzed and the analysis revealed a WM =3.57 which means that learners positively agree on the appropriateness of the SCLS's content while with a WM =3.80, learner's response on their level of constructing knowledge using the SCLS is evidently positive. Figure 3 shows a graphical representation on student's responses for their understanding and comprehension.

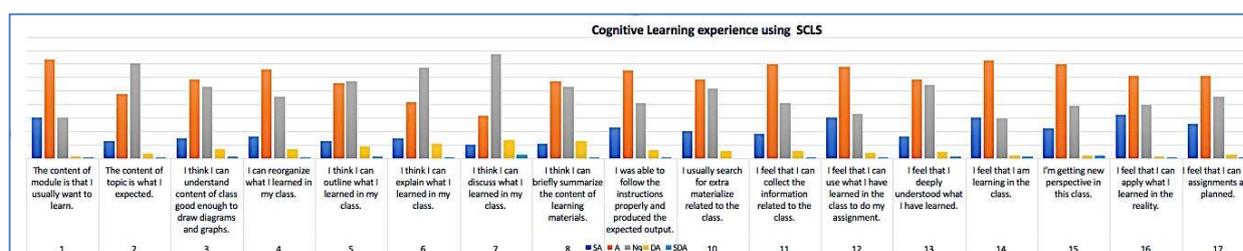


Figure 3. Student's level of understanding and comprehension

3.3. Analysis on the impact of SCLS to learner's cognition

To analyze the impact of SCLS to student's cognition, results on their activity was used as Dependent Variable (DV) while Independent Variable (IV) includes (a) their frequency of use to SCLS, (b) Time spent in activity, and (c) level of understanding and comprehension. The result has provided a scientific explanation to compare the hypothesis where H_0 : The SCLS has no impact to the learner's cognition; H_1 : SCLS has an impact to the learner's cognition. One-way ANOVA and regression analysis was used to produce scientific data. As to the frequency of use and activity result, analysis has resulted to coefficient=3.95 where a lower limit of the 95% confidence interval level was used and t-stat=24.01 which resulted to $p=0.002<0.05$, thus H_0 can be rejected because there is a significant difference between frequency of use of SCLS and the score obtained in their activity. As to the time spent in taking the activity with $M=2.53$ (≥ 1 hour) and result in their activity with $M=12.96$ where 24 is the highest score, there is a significant difference of 0.43 and 30.62 correspondingly which has a $p=0.000<0.05$ with $\Omega^2=0.0636$. Further, Figure 4 shows a positive relationship between time spent in activity and quiz where the value of y at x-axis = $0.067 + 1.906$ and $R^2=0.124$. Also, the impact of SCLS to cognition using the presence scale where (a) level of understanding was analyzed, a $M=3.56$ with 0.24 variance to that of score in their activity with $M=12.96$ and 30.62 variance has resulted to a $p=0.000 < 0.05$. Correspondingly, SCLS has also an impact to the cognition of learners where learners score to activity has a variance of 0.30 with Mean=3.80 and their level of comprehension with 30.62 variance of Mean=12.62 and a $p=0.000<0.05$. With all the computed results, the SCLS has a constructive impact to the learner's cognition. With all the computed results using DV and identified IV's, the SCLS has a constructive impact to the learner's cognition. Noticeably among the learner's profile, analysis has revealed that student's engagement to SCLS has no impact to the learner's cognition where $p=0.686>0.05$ in contrast to the study to [28].

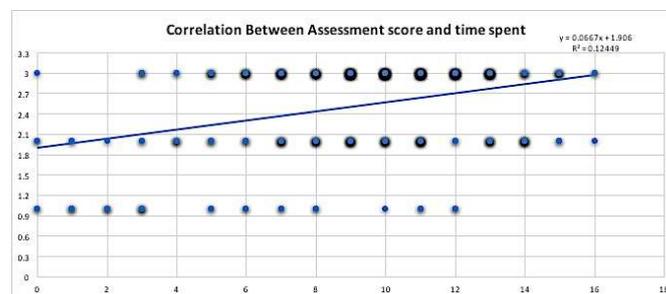


Figure 4. Correlation between time spent and activity scores

3.4. Analysis on the impact of SCLS to learner's social learning

Learners were asked on their social learning experiences as to the use of SCLS during the day 2, 3, 4 activities and a nominal question was used where 5 is the highest and 1 is the lowest. The collected Mean on student's social learning experience was used as the dependent variable while learners profile on their (a) engagement (b) frequency of use (c) time spent and (d) understanding and comprehension was used as independent variables.

With the overall weighted mean on student's responses using T-test assuming equal variances, analysis has revealed that student's engagement has significant difference to social learning where a pooled variance=0.07 to that of social learning Mean=3.72 and a variance of 0.20 was uncovered. The computed $p=0.000<0.05$ with critical value =1.96 further shows a significant difference. Similarly, using the analysis of variance (one-way) ANOVA, the frequency of use revealed a significant difference to social learning experience where Mean=3.16 and total variance of 1.37, resulting to $p=0.000<0.05$ with $\Omega^2=0.23$. Consequently, time spent to take the activity and their social experience was analyzed which has resulted to a Mean=1.86 and a variance=3.57 with $p=0.000<0.05$ and $\Omega^2=0.97$. The result further showed that time is an important factor to consider student's engagement and social learning when working in a group. Also, allowing learners to work in a group improves

their ability to understand the content of concept notes where Mean=3.64 and variance=0.23 with computed $p=0.000<0.05$ and $\Omega^2=0.024$. Correspondingly, analyzing student's level of constructing knowledge has a significant difference to the social learning experience of learners where a computed Mean=3.76 and variance=.0.25 with $p=0.000<0.05$ and $\Omega^2=0.004$. Further, to analyze learners score after taking 3 activities where activity requires a team work, Figure 5 shows a significant effect of group activity score as compare to individual activities.

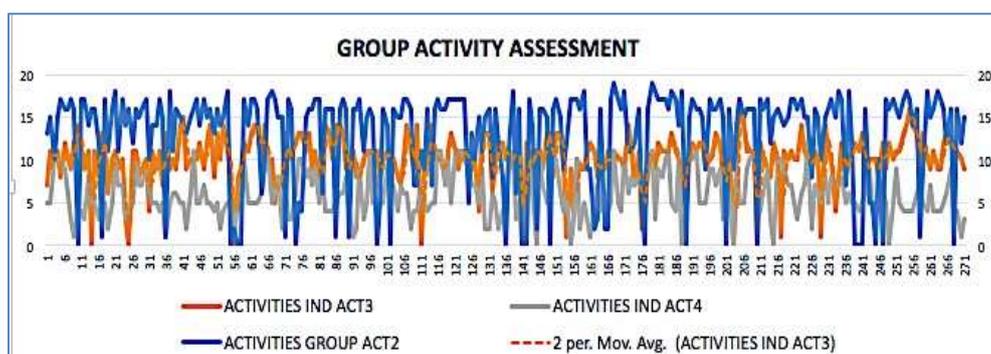


Figure 5. Comparison of assessment for individual and group activities

4. Conclusion

The research study has been strongly motivated to answer the query on knowing the potential qualities of a technology-mediated learning environment as an aid to increase learner's cognition and social learning capabilities. It is mainly guided to look at the significant difference of the several learners' profile variables which has resulted to $p\text{-value}<0.05$ as to their cognitive and social learning abilities in the presence of an e-learning application tool.

Moreover, the SCLS impact to student's cognition and social learning has shown significant difference to their level of engagement and comprehension. Specifically, student's profile such as engagement, frequency of use, time spent in an activity and level of comprehension have positively indicated that there is an impact of using the SCLS to student's cognition. The study also emphasizes the utilization of the SCLS which greatly impact the social learning of the learners when correlated with the same variable as mentioned in the cognition. This would simply mean as the learners are more engaged in the SCLS, the higher the outcome they get. Thus, SCLS is an effective tool in enhancing student's capabilities in cognition and social learning. The study however does not include factors influencing social-emotional learning or the affective domain of the learners. Therefore, further studies are highly encouraged. As a supplemental effort in the paradigm-shift of teaching and learning approaches in higher educational institutions, taking into consideration of the affective domain of the learners would essentially give the teachers newer perspective in making the learning environment truly conducive to all type of learners with the integration of technological tools. Further, since the learning environment is dominantly heterogeneous, knowing the varying emotions of the students could led to an effective means of learning process.

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