A META-ANALYSIS OF RESEARCH OF PROBLEM SOLVING ACTIVITIES IN ONLINE DISCUSSION

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INTRODUCTION

Today, technology has changed the teaching and learning method. Most of instructor and students are using computer and online medium to implement teaching and learning method even though they are not in the classroom. By using online medium, teaching and learning also can be occurredat anywhere andat anytime. Within the learning process, psychological processescan be occurred and same goes to online learning.Psychological processes could perform any types of activities that use a variety of processes such as thinking, remembering, problem solving, interpretation and others. One of the psychological processes in online learning is problem solving.Problem solving refers to the mental process that involves discovering, analyzing and solving problems (Cherry, 2003).Nowadays, by using variety of online medium,problem solving can be applied within teaching and learning through online discussion.This paper discusses about a meta-analysis of research of problem solving activities in online discussion.

There are a lot of online learning medium that are used within discussion among students through online learning. For example,Facebook, e-learning, web based online, blog and online forum are the online medium used for online discussion.

FINDING OF ANALYSIS ON SELECTED PAPERS

The purpose of this study is to identify types of learning activities through online discussion regarding to the problem solving. The following keywords were used in searching for related publications; problem solving in online discussion, problem solving in online learning, activities in online learning, and problem solving in online forum. We used IEEExplore, Digital Library, Science Direct, and Pro-Quest in searching for those publications. The search has produced 45hits, but only 9 were selected and relevant to this study. These selected publication were chosen according to these criteria: 1) the study focuses on problem solving activities; 2)the study must be published between 2005 until present; 3) the study focuses on higher education, 4) the study must use online medium. Table 1 shows the list of the studies related to the topic discussed. We start with reviewing the brief explanation of the each study selected, followed by limitations and some future suggestions for improvement for the next research.

Table 1 List of studies on research of the problem solving activities in online discussion

Author (s)	Participant (s)	Type of Activity (s)	Learning Activities	Medium
Suh, S. (2005)	61 students were enrolled in an introductory course in educational technology (EME2040) in the College of Education at	Project scenario (3weeks)	Students received a project scenario and they posted their reflection of problemsolvingstrategies on the online discussion board after engaging in creating solutionswithPowerPoint, Word, Excel, and Inspiration software. applications. All students	online discussion board

			had to access the blackboard coursewebsite to discuss a given topic.	
Toy,S. (2007)	64 teachers' education students	Problem Scenario (2 hours)	The instructor gave the students a problem scenario regarding of multimedia project Then, students will discuss among them to find the solution through portal.	Problem Solving Learning Portal (PSLP)
Oldenbu rg, N.L (2008)	30 RN-BS student is a registered nurse who is completing requirements toward a baccalaureate degree in nursing.	Case Study	The instructor gave students 7 case studies regarding the patient diseases in several situation. Then, students were asked to find the solution how to cues every cases through blackboard, students are able to post comments to discussionforums as well as to attach documents for review by other group members.	Blackboard ™ a course managemen t system
Hou, H.T (2010)	32 university students who are majoring in Information Management at a university in northern Taiwan.	case scenario (7days)	*Case Scenarios* : the instructor designed and assigned a certain case in organizational management. The students analyzed the problems faced by the firm, and then they proposed solutions and suggestions. This activity required students to solve issues of organizational management in a MP3 Player company	Online forum

		problem-solving tasks assigned by the teacher (7days)	*Problem-solving tasks assigned by the teacher:* the students were required to solve issues of organizational management bottlenecks faced by a real estate brokerage company. Before the commencement of the task, the descriptions of the case scenarios and the problem-solving tasks were stated in the forum.	
Hou,H. T. & Wu, S.Y. (2010)	40 students enrolled in the same elective course, Web Design, at a university in northern Taiwan.	case study (98days)	The participants were put into five groups of seven to ten students. After the tasks were announced, the students from each group were asked to conduct collaborative discussions on the tasks and exchange ideas until they reached a conclusion.	instant messaging (IM) tool
Chang, Y.S (2012)	107 fourth-grade students selected from Taipei City (urban area), Taipei County and Hualien City (suburban areas), and Hualien County (rural	problem-solving tasks assigned by the instructor	Students were given learning activity by the instructor that require them to produce their own electronics car models.Students were asked by instructor to use CPS to create their own model and discuss together among them.	online (web-based) creative problem-solving (CPS)

	area) in Taiwan.			
Xia,C.J, Fielder,J., &Siragusa, L. (2013)	30 students participated in the discussion forums who enrolled in the Geographic Data Analysis (GDA)	case study	Students enrolled offshore, in different states, or in rural areas of Western Australia were unable to attend on-campus lectures and tutorials so, instead, had access to online lectures recorded by screen capturetools and simulated fieldwork, and online tutorials.	Online Discussion forum
Ioannou,A., Brown. S.W., &Artino. A.R (2014)	34 graduate students in two sections of an online course on learning theories at a public university in Northeast USA.	Case problems: Case A (weeks 10–11) Case B (weeks 12–13)	Students were randomly assigned to groups of 3–4 students to work on Case A. During weeks 12–13, the same groups worked on Case B, Using mediawiki and discussion board. In order to guide their activity, students were providedwith guidelines on how to approach the analysis of the case problem.	MediaWiki discussion board within Blackboard WebCT
Lin, P.C., Hou,H.T, Wu,Y.S., & Chang, K.E (2014)	45 students from the College of Management at a university in northern Taiwan	Collaborative Problem Solving (2hours)	Before the students engaged in the given network troubleshooting tasks, the instructor explained the network troubleshooting problemsand the goals of the tasks to the students.All of the groups were given the same network	Facebook

simulation-based instructional approach (16 weeks)	troubleshooting task (i.e., solving a network connection problemin a company) on Packet Tracer. At the beginning of the task, each student could operate and test the network - environment on a computer. The instructor provided each group with an online learning sheet. This sheet explained that students could have problem-based discussions within their group's private Facebook group (each group used one private Facebook group).

According to table 1, learning activities that have been used are projectscenario, problem scenario, case study, case problem, case scenario, problem solving task assigned by teacher or instructor, collaborative problem solving and simulation-based instructional approach. The dominant learning activities that have been used by researcher are scenario and case study. From 9 publications, 3 researchers used scenario and 3 researchers used case study.

BRIEF EXPLAINATION OF EACH STUDY

Generally table 1 discovers all of the learning activities that has been used in online learning discussion. Three researchers applied scenario in their study are Suh (2005), Toy (2007) and Hou (2010). Suh (2005)investigated on how to enhance complex problem

solving in web based instruction by using online discussion board. This study used collaborative groups guided questions in a hybrid web-enhanced learning environment inwhich students attended class face-to-face and online.The result of ANOVA indicated that there was a significant interaction ofcollaborative groups on students' performance. The students who worked in collaborativegroups without the guided questions (GC) performed better than those who workedindividually without the guided questions (IC). There were limitations on observation of group interaction. Students were asked to discuss in online discussion but some of them met face to face after class section to discuss. Therefore, there is a limitation to capture all of the students interaction outside of classroom. However, this study do not cover the training for students preparation onhow to moderate group discussion and problem solving since some students are not familiar with the collaboration. Another study done by Toy (2007) using Problem Solving Learning Portal (PSLP) aims two objectives;i) to characterize students' ill-structured problem solving strategies in a Web-based problem-solving environment andii) to examine the effect of these problem-solving strategies on students' problem-solving performance. The finding was the use of cluster analytic techniques and examination of clickstream data made it possible to identify and characterize different problem-solving strategies individuals used while completing the online ill-structured problem-solving task. However, these differences did not reach significance probably due to the small sample size. By using the larger samples may help better demonstrate the relationships between these variables and ill-structured problem-solving performance. This study does not investigate intrapersonal and external variables that might help better explain what kind of individuals may be more effective problem solvers.

Hou (2010) explored the learning process of adopting collaborative online instructional discussion activities for the purpose of problem-solving using situated scenarios in a higher education course by using online forum as an online medium.

According to him, the task required students to propose solutions to organizational restructuring for the existing bottlenecks, they could see that the majority of students merely skimmed the surface of the company's status (e.g.poor sales) when they put forward their views during discussion. Finding showed that they lacked depth in problem-solving and in analysis and discussion.However, the In terms of solving the problems presented in the assigned task, the students' analysis lacked depth. Moreover, the students lacked an organized process for reaching a solution. There were many superficial messages that lacked depth and specificity. The role of teacher is important, but this study does not cover for that. For example teacher should introduce role-playing into discussion-based learning activities using situated scenarios. Besides that, teacher may observed students' daily online discussion.

Case study were done by 3 researchers. They areOldenburg(2008), Hou and Wu (2010), and Xia, Felder and Siragusa(2013). Oldenburg(2008) done a study based on the frameworks of problem based learning and the community of inquiry model used Blackboard™ a course management system. The purpose of this study was to explore the problem-solving experiences of a group of six nursing students in an online problem based learning course. The finding from this study indicates that, eventhough at the initial phase, there were misgivings about the effectiveness of group problem solving, students successfully worked through the six cases and reported positive feelings about group process. They were engaged and active, posting nearly 700 comments on the discussion board during the semester. However, there is the possibility that students did not share their honest perceptions. This course involved one group of RN-BS students at Northern Illinois University so that the result will be bias to students in other settings. This study do not cover utilizing alternatetheoretical frameworks as the basis for coding would serve to expand theknowledge base of problem-solving strategies. Besides that, It is important to anticipate and provide guidance for problems such as these, particularly when working with learners

who have limited online experience. This guidance should include discussion of online search strategies and evaluating the credibility of resources.

A study done Hou and Wu (2010) revealedbehavioral patterns and they have provide specific suggestions for teachers regarding how to implement synchronous discussions that are targeted to students' knowledge construction processes by usinginstant messaging (IM) tool.They found that real-time coordination is beneficial to discussion tasks, and coordination involves joint decision makingrather than independent or arbitrary assignments. The high-quality discussions have more coordination related discussions, especially on themethods of task coordination.The limitation of this study was their focus on general collaboration discussion tasks, which could lead to limited diversity in knowledge construction. Besides that, students also had more off-topic during the discussions. Due to the unstableinternet connection, it also gives problems to students to discuss in online discussion. However, this research does not cover the teacher roles asthe observer. The teacher will observe students' knowledge construction in an initial discussion task to determine the discussion quality of eachgroup and introduce guidance to low-quality teams. For example when one group have problem, the teacher will give a hint for them to get the solution. The teacher could also facilitate the discussion process and developstudents' argumentative abilities(Driver, Newton, &Obsorne, 2000; Erduran, Simon, & Osborne, 2004).

Xia,John &Siragusa (2013) used an online discussion platform to investigate the relationship between the frequency of students' postings on the blackboard forum and their final marks, relationship between the role students played in the discussion forum and their final marks and also the relationship between response time lag and student engagement on the discussion board.

The results revealed that it increased student participation levels were achieved in this process of problem solving. There is a reasonably strong level of statistical association between the roles

students played in the discussion board and their final marks. Besides that, the time lag between the students making postings (particularly around the time when assessment items were due) and the lecturers' responses was found to be beneficial to the students' active learning, as it allowed them time to help each other with the assessment items.The limitation in this study several students who did not participate in the online discussions, but who still attained high final results. However, this study does not cover why some students are not participating in the discussion. Besides that, researcher should create an instrument to measure students' roles in the discussion forum and their learning styles, and a better measure to assess students' qualitative andquantitative.

Then, problem solving task assigned by instructor was used by Chang(2012) and Hou(2010).Chang (2012)investigated the effects of online (web-based)creative problem-solving (CPS) activities on student technological creativity. The purpose of his study is toexamine the characteristics of student creativity in the context of online CPS. This study reported that according to the preliminaryanalysis, students' networking concepts and network troubleshooting abilities improved after the activity.The limitation in this study is many students plagiarise other idea. They duplicate other students' idea. However, this study does not cover the characteristics of student technological creativity and a synchronous multimedia interaction system when designing online CPS activities and web pages.Hou(2010) found from the discussion,students raised a variety of different viewpoints and through comparisons and analysis came up with some organizational management ideas for the organization. The students were able to understand and analyze the issue from different perspectives, make connections, and propose solutions. The limitation in this study is the students lacked an organized process for reaching a solution. There were many superficial messages that lacked depth and specificity. However, the sequential patterns of the student's overall behavior and the social interaction still do not be analyzed and explored. By integrate a

variety of analytical methods to enable more in-depth exploration of the instructional online discussion strategies withrespect to their features and limitations.

The other study done by Ioannou, A., Brown. S.W., and Artino. A.R (2014)applied problem case and choose wikiand discussion board within Blackboard WebCT as an online medium todescribe an experimental study that evaluated differences in students' discourse and actions while they discussed in online.They reports that statistically significant differences in the use of a wiki with discussion versus a forum with attachedMS Word documents for virtual collaboration on case problems with a group essay being the finaldeliverable according the applying case problem. The limitation in this study is the present investigation lacks a theoretical frameworkto explain and predict how tools (wikis and forums) might affectthe collaborative processes by eliciting and supporting varioustypes of interactions. However, this study donot focus on presenting a theoretical account of how wikis and forumsaffect the collaborative process.

Last but not least, Lin, Hou,Wu, and Chang (2014) aims to analyze learners' cognitive processing patterns in a collaborative problem-solving (CPS) teaching activity that integrates Facebook discussion tools and simulation-based teaching software by using Facebook as a medium.They revealed that members ofthe manipulation-centered groups spent more time conducting testsin simulated environments and that their discussions aimed to provide other group members with applicable results (C3, apply) (C3 is 14.12%,which is higher than the 3.77% exhibited by the discussion-centeredgroup.The limitation in this study are only a pre-test and posttestto evaluate the effectiveness of student learning and analysis represents only an initial understanding of student learning effectiveness.However this study does not cover consider enhancing the performance assessment by using the simulation software before and after the activity and establishing appropriate scoring standards. Other than that, the use of a sufficient amount of discussion time andmore in-depth cognitive levels need to cover

for some students have pressure for having discussion.

LIMITATION

There are some shortcomings or limitations in implementing problem solving activities through online discussion. This is due to several reasons. First limitation is about students contributions in the online discussion. Some students might not be involved in the online discussion. According to the research done by Xia,John &Siragusa (2013), some students did not contribute in the online discussion forum. Other than that, a study doneHou and Wu(2010) stated thatduring the discussion process of joint knowledge construction, discussion may be broken off due to technical issues with internet connection. They also stated that more than half of the discussions were off-topic. Next, according to Chang (2012) stated that, Many students constructed ideas by refining and adjusting others' thoughts. They do not give their own idea but just duplicate others idea. Last but not least, according to the study done byIoannou, A., Brown. S.W., &Artino. A.R (2014), the present investigation lacks a theoretical framework to explain and predict how tools (wikis and forums) might affect the collaborative processes by eliciting and supporting various types of interactions.

FUTURE SUGGESTIONS

In order to improve the impact of problem solving activities in online discussion, several recommendations should be considered. Firstly the instructor or teacher should design creative activities that can attract more students' attention to contribute in the problem solving activities in online discussion. Xia, Fielder and Siragusa (2013) also suggest that designing and implementing more effective activities to increase student participation in discussion forums. This also support by the Chang(2012) who mentioned that a synchronous multimedia interaction system

should be developed and applied in online collaborative problem solving activities.

Besides that, the roles of instructor and teacher are also important in implementing problem solving activities online discussion. The instructor should play a role in the online discussion. They should not only just give tasks to the students, but also contribute in the discussion to guide students in their discussion. Hou(2010) suggest that teachers are advised to introduce role-playing into discussion-based learning activities using situated scenarios. He also mentioned that if teachers can intervene at the early stages of activities and provide guidance to prevent certain groups of student from the habit of low-participation. Study done by Lin, Hou, Wu, and Chang (2014), suggest that teachers should provide more feedback and guidance for discussion-centered groups to facilitate a more in-depth analysis of the manipulation results. Next, Hou and Wu (2010) suggested that teachers are thus advised that when conducting synchronous discussions, they should consider ways to promote participation, reduce off-topic discussions, and introduce appropriate incentives (such as extra credit or praise) to encourage students to stay on-topic.

CONCLUSION

Problem solving activities not only applied in the face to face learning, but also in online learning which is applied in online discussion. The development of technology approach nowadays most helpful to teacher and students in order to apply their problem solving activities in online discussion. Thus, students and teacher should alert and always construct their knowledge and skill in using new technology platform to make the teaching and learning successful and enhancing their performance in any subject learning whether at school or any institution.

REFERENCES

Chang, Y.S (2012). Student technological creativity using online problem-solving activities. *Int J Technol Des Educ (2013) 23:803–816.*

Cherry.K(2003). What Is Problem-Solving? [Homepage on the internet]. Retrieved October 27, 2014, from http://psychology. about.com/od/problemsolving/f/problem-solving-steps.htm

Driver, R., Newton, P., &Obsorne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education, 84, 287–312.*

Hou, H.T. (2010). A case study of online instructional collaborative discussion activities for problem-solving using situated scenarios: An examination of content and behavior cluster analysis. *Computers & Education 56 (2011) 712–719*

Hou,H.T. & Wu, S.Y. (2010).Analyzing the social knowledge construction behavioral patterns of an online synchronous collaborative discussion instructional activity using an
    Instant messaging tool: A case study. *Computers & Education 57 (2011) 1459–1468*

Ioannou, A., Brown. S.W., &Artino. A.R (2014). Wikis and forums for collaborative problem-based activity: A systematic comparison of learners' interactions.*Internet and Higher Education 24 (2015) 35–45.*

Lin, P.C.,Hou,H.T,Wu,Y.S.,&Chang, K.E(2014). Exploring college students' cognitive processing patterns during a collaborative problem-solving teaching activity integrating Facebookdiscussion and simulation tools.*Internet and Higher Education 22 (2014) 51–56.*

Lou.Y (2007).Learning to Solve Complex Problems Through Between-Group Collaboration in Project-Based Online

Courses. *Distance Education, Vol. 25, No. 1,*
Liu. Z.L, Zhang. Z and Chen. Y (2012).A scenario-based approach forrequirements management inengineering design. Concurrent Engineering: Researchand Applications20(2) 99–109.
Mayotte.S (2010).Online assessment of problem solving skills. Computers in Human Behavior 26.1253–1258
Oldenburg, N.L(2008*). An Analysis of the Problem-Solving Experience of Students in an Online Problem-Based Learning Environment.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses.
Suh, S.(2005).*The Effect of Using Guided Questions and Collaborative Groups for Complex problem Solving on Performance and Attitude in a Web-Enhanced Learning* .(Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (Accession Order No. UMI 3216655)
Toy,S.(2007).*Online ill-structured problem-solving strategies and their influence on problem-solving performance.*Thesis report, Major: Education (Curriculum and Instructional Technology).Iowa State University.
Xia,C.J, Fielder,J., &Siragusa, L.(2013). Achieving better peer interaction in online discussionforums: A reflective practitioner case study. *Issues in Educational Research, 23(1).*