

Problem Solving Performance mediated by Online Discussion Board: Review from Gender and Internship Exposure

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ABSTRACT

Background: The study emphasis on the problem solving performance specifically quality and confidence of solutions proposed using online discussion board called Collab2learn Discussion Board (DB). **Objective:** The research objective of the study is “to suggest the suitable combination of gender and internship exposure at different synchronicity and feedback format on solutions proposed by using online discussion board”.

Results: The study presented quantitative results indicated synchronicity had significant effect to solutions’ quality and confidence at different gender. **Conclusion:** It is suggested to have symbiosis between male and female learners during collaborative problem learning because both have produced high average scores for quality and confidence in proposed solutions.

INTRODUCTION AND PROBLEM STATEMENTS

Problem based collaborative learning can be described as students in group consisted of two or more person working together, interacting and contributing to solve the same problem or complete a task (Dillenbourg, Huang & Cherubini, 2008 and Dewiyanti, Brand-Gruwel & Jochems, 2007). Collaborative learning effected positively to learning achievement and collaboratively solving problems will influenced learners understanding of knowledge thus increased their cognitive development. Vygotsky Sociocultural Learning Theory (SLT) has described interactions and communications between learners will construct their understanding during solving problems (Fosnot & Perry, 2005 and Cole, John-Steiner, Scribner & Souberman, 1978). Communication, interaction and collaborative activities within the supportive learning environment will help learners or students’ to master their own knowledge or current knowledge development and achieve their potential knowledge when they were given task or problems (Cole, John-Steiner, Scribner & Souberman, 1978 and Zainuddin, Abdullah & Downe, 2010).

Male and female students participated in collaborative learning at different level of performance (Swenson & Strough, 2008). Previous studies shown similar academic performance occurred between male and female students, however female students are identified to participate higher collaborative learning compared to male students. Collaborative learning involved either group with same gender or male-female group. Collaborative learning mediated with computer applications are widely implemented in learning institute. Schools and institute of higher learning developed e-learning applications to support teaching and learning environment. In e-learning application, learners and instructors are able to share teaching and learning materials, assess class tasks, manage class profile, communicate and conduct online discussion using online discussion board or chat tool. These activities occurred during collaborative learning whereby learners communicate and solve the same problems assigned by instructors.

Online discussion board was developed to support e-learning application in institute of higher learning. Online discussion board promotes learners to discuss and share learning tasks identified by instructors. Its learning content can be varied such as academic technical subjects such as Mathematics, Sciences and Chemical or non-academic subjects.co-curriculum, languages and soft-skills subjects. Discussions conducted through online environments allow learners to share electronic documents and interact with their group mate (Dillenbourg, Huang & Cherubini, 2008).

Currently, there is no online discussion board discussing on workplace scenarios implemented in polytechnics or community colleges in Malaysia. Curriculum Information Document Online System (CIDOS) allows students to share documents related to learning topics using multi format quiz (list box, check box (multiple choice or true/false) for assessment purposes, chat tool for synchronous communication and multithread forum for asynchronous communication (Ali, 2011). Similar multithread forum is applied for e-learning at Universiti Science Malaysia (elearning@USM, 2013) whereby students are allowed to communicate with others and feedback is given in written format. Implementation of online discussion board developed with both asynchronous and synchronous communication type that allows reflective activity based on feedback to group members' contribution motivates the study to develop a prototype for online interaction and communication between students.

Collaborative session is accelerated with the support from communication tools implemented. Different synchronicity created different effect for learners learning. Synchronous tools allow real time communication and instant interaction occur, however asynchronous tools are flexible whereby learners may receive feedback or comments at longer time. Learners are able to give instant feedback or comments allowing negotiation of principles and ideas between their group members in synchronous learning session occurs promptly because learners are gathered at the same time during a short period. Learning session in asynchronous occurs within a week or more depending on the topics provided and learners are flexible to attend learning session anytime during the long period, thus interaction between learners are not instant and negotiation of knowledge and principles takes longer time.

Feedback can be defined as information provided by an individual concerning the performance or understanding of a learner with reference to improve on learning (Voerman, Meijer, Korthagen & Simons, 2012). Positive or negative feedback can both enhance students understanding of learning as long the feedback contains enough information for learners to understand either it is right or wrong. Textual buttons or iconic buttons are designed on several web sites as feedback buttons. Facebook (<http://www.facebook.com>, 2011) implemented the textual "Like" button and pop-up advertisement (<http://www.yahoo.com>, 2013) implemented the iconic thumbs up button.

Learners discuss problem through online collaboratively and to support and promote e-learning using online discussion board had motivated the research to develop Collab2learn Discussion Board (DB). The discussion board allows learner to learn collaboratively within their specified groups. The study emphasises on problem scenarios as the learning content specific with issues related with workplace environments. Learning activities such as comments were contributed and shared during participating online discussions. Comments contributed by learners were measured as proposed solutions. All proposed solutions were measured for its' performance and the results were compared between gender at different synchronicity and feedback format.

The study aims to explore problem solving performance using an online discussion board called Collab2learn DB. The quality, confidence, quantity and speed of proposed solutions are measured between learners at different gender and internship exposure based on synchronicity and feedback format.

LITERATURE REVIEW

Discussions, communication, contribute and share knowledge and working together to solve the same tasks can be described as collaborative learning (Smith, 2003). Learning institutes have implemented collaborative learning as teaching and learning strategy in their academically environment. Technologies mediate teaching and learning is widely applied by learning institutions to help and assists teachers or students in learning environment. Computer, projectors, Personal Data Assistant (PDA), laptops and learning systems are some of the common teaching and learning aids used by teachers or students. Discussion board developed to support collaborative learning session through the internet. Online discussion board does not allow learners from different location to 'meet physically; however, learners can share information, knowledge and electronic documents easily through online. Communication and interaction occurs between learners-learners or learners-instructors using online discussion board easily in different synchronicity. Two types of synchronicity identified from various studies: synchronous and asynchronous. Synchronous is refers to real-time activity. However, asynchronous refers to flexible-time activity. Each synchronicity affects differently to the participants' activity and experiences (Chiu & Hsiao, 2010; Resta & Laferriere, 2007; Jara et al., 2009).

Communication, interaction, sharing and transferring knowledge and information occurred actively during discussing online. Topics and tasks posted in the discussion board required learners' comments and arguments. Comments given during discussions are known as response or feedback from learners. All comments to a certain post can be described as solutions, answers or suggestions to the

posted question. Comments contributed by learners are in textual or sentences format. All comments can be treated as the proposed solutions as long the content are understandable and related to the posted question. There are no right or wrong suggested solutions and all comments will be measured for its' performance.

Communicating, interacting, sharing and exchanging documents through the network are common because of unlimited and unconstraint on time, location and physical boundary for users. Students are able to communicate with their peer, instructors and teachers easily using online discussion board. Sharing and giving knowledge or information will increase their knowledge as well will create social acceptance environment in learners. Studies have shown interacting and communicating using online communication tool will contribute to learners' motivation for learning (Gokhale, 1995). This was reflected through giving feedback to ideas and comments shared by learners within their group.

Discussions conducted through online environments allow learners to share electronic documents and interact with their group mate. Key-in comments contributed during online discussions would be suggestions or ideas to solve tasks given by their instructors. Comments or suggestions produced based on given tasks are measured on its performance. Active participation will promotes higher comments or solutions to problems given as teaching and learning material. The quality and confidence of proposed solutions should be measured parallel with the quantity and speed of solutions generated from online discussions.

The structure design of a discussion board allows users to view comments, participate in the discussion and give feedback to others comment at the same time is similar with thread comment design (Caballe & Feldman, 2008); with exception to the topics are not the same displayed in the same page whilst topics are in sequenced for thread comment design. Specific type of collaboration is suggested for the study prototype whereby users may participate either in asynchronous or synchronous discussion session and non specific feedback either in textual button or iconic button format.

Type of participant in collaborative learning influences collaborative performance. Collaborative learning may be in face to face or over the internet. Both format contribute to learning performances, however online collaborative learning scored higher average (mean) scores compared to face to face collaborative learning (Maesin, Mansor, Shafie & Nayan, 2009). Students' participated in collaborative learning can be divided either in same gender or male-female group. Studies shown the academic performance between female and male in learning collaboratively are similar specifically during their communication style but there are studies discover female tends to maintain group performance while male prefer to complete the tasks. Lai (2011) explains, in collaborative learning group mixed with male and female within the same interaction pattern; male outperformed female in discussion, giving and receiving more elaborate explanation and the explanations are agreed by others compared to female. This result is supported from a study on brain activity between men and women, male are more fluent verbally compared to female, however this result is based on magnetic resonance imaging instead of reality task performances (Bell, Willson & Wilman, 2006).

Internship produced benefits for both learning institute and students in building relationship with businesses that will eventually hire students as their employees. Internship provides temporary employment emphasis with on-the job training for students (Walker, 2011). Employment soft-skills such as interpersonal interaction, oral and written communication, decision making, problem solving, time management and leadership skills are formed in students. Pre internship are exposed with work experience during the internship session, and assume to produce significantly higher oral communication, interpersonal interaction and leadership skills (Sharbatoghlie, Mosleh & Emami, 2011) in their post internship through maturation (Green, Madison & Callahan, 2007).

Students in different gender and internship exposure are assumed to influence with their learning performances. The role of online discussion board participated by students in both factors at different synchronicity and feedback formats are expected to produce attractive result that will benefit to the study theoretically.

METHOD

1. Research Design

This study is designed as experimental study on selected participants. A developed prototype called Collab2learn Discussion Board is used as the external tool for collaborative learning sessions. Several workplace scenarios are designed as the learning content. Participants communicate and discuss within their group on questions based on problems in the scenarios. Quantitative analyses to explore identified variables are conducted for the study.

2. Research Framework

The research framework explore the problem solving performance at different gender and internship exposure. System synchronicity and type of feedback implemented in Collab2learn DB are measured for its effect to participant learning performance. Problem solving performance are measured based on the quality; Solutions Quality (SQ) and confidence; Solutions Confidence (SC).

3. Research Objective

The research objective for the study is “to suggest the suitable combination of gender and internship exposure at different synchronicity and feedback format on solutions proposed by using online discussion board”.

4. Research Question

The research questions for the study are:

1. Does gender affect problem solving performance using online discussion board at different synchronicity and feedback format?
2. Does internship exposure affect problem solving performance using online discussion board at different synchronicity and feedback format?

5. Sampling

Participants are selected from three higher learning institutes (Politeknik Ungku Omar, Kolej Komuniti Sungai Siput and Universiti Teknologi PETRONAS) and they are information technology (IT) literate. Initially, 813 students are divided to groups and participated in Collab2learn DB within their specific groups. Group members' are selected by researcher randomly from different classes uninformed to the students.

Descriptive analysis for normality of data is conducted for initial sample and four (4) outliers are identified and deleted. Only 809 data are carried in further analysis and 480 data are randomized for ANOVA.

6. Experimental Procedure

Selected participants log-in to Collab2learn Discussion Board web site using their given ID. They were assigned to specific group randomly. Workplace scenarios were displayed and each scenario has one question to be discussed by participants. All comments and feedback either 'Agree' or 'Disagree' are displayed below the scenario. Participants are allowed to agree or disagree their group members' comments excluding their own. All participants were given a nickname and they are allowed to give comments more than once for each scenario.

All learning sessions are limited to certain period. Synchronous learning session was constrained for one hour and asynchronous learning session was constrained for 168 hours/ 7 days. Participants are free to answer questionnaires if they completed all the scenarios or the questionnaires will automatically display if the learning period has ended.

7. Questionnaire Design

Questionnaire is designed to measure Solutions Quality (SQ) and Solutions Confidence (SC). Electronic questionnaire will automatically generate at the end of learning session for each participants. Participants are allowed to answer several times, but only the latest answer will be used for further analysis. 6-point Likert scale (1- Strongly Disagree, 2- Mostly Disagree, 3- Disagree a little, 4, Agree a little, 5- Mostly agree and 6- Strongly Agree) is used to measure nine (9) items for SQ and six (6) items for SC (Sekaran; 2003 and Uden & Beaumont; 2006). All items are positively worded except one item measuring SQ.

8. Reliability Analysis

SQ and SC is pilot tested for reliability participated by 170 students participated. SQ1 was positively reversed in reliability analysis. Solutions Quality consisted with nine (9) items with $\alpha = .881$ while

Solutions Confidence consisted with six (6) items with $\alpha = .945$. Both instruments for SQ and SC are considered reliable with α more than .800 in reliability analysis (Sekaran, 2003).

Table 2
Reliability analysis result for SQ and SC

Factor	Reliability Coefficients	Cronbach's Alpha (α)	Standardized item alpha
Solutions Quality (SQ)	9 items	.881	.889
Solutions Confidence (SC)	6 items	.945	.945

RESULT AND ANALYSIS

Analysis of variance (ANOVA) and T-test analysis were conducted to explore the relationship between variables. Results and analysis were described in this section.

1 Result for research question 1

Question 1: Does gender affect problem solving performance using online discussion board at different synchronicity and feedback format?

Multiway Analysis of Variance (ANOVA) is conducted to explore the effect of gender with SQ and SC at different synchronicity.

Referring to Table 3, statistically, there were significant result between gender to both SQ ($p = 0.022$) and SC ($p = 0.047$) at different synchronicity. Synchronous learning sessions dominated higher mean scores compared to asynchronous learning session. Male participated in synchronous learning session carried highest average score for both variables; SQ (Mean = 4.523, SD = 0.662) and SC (Mean = 4.732, SD = 0.833) compared to female.

Table 3
Results for gender with SQ and SC at different synchronicity

SQ	Male			Female			Significance (p)
	n	Mean	SD	n	Mean	SD	
Synchronous	120	4.523	0.662	120	4.275	0.780	*0.022
Asynchronous	120	4.381	0.669	120	4.416	0.633	
SC	Male			Female			Significance (p)
	n	Mean	SD	n	Mean	SD	
Synchronous	120	4.732	0.833	120	4.471	0.991	*0.047
Asynchronous	120	4.553	0.777	120	4.599	0.751	

$p=0.05$

Referring to Table 4, statistically, there were no significant result between gender to both SQ ($p = 0.372$) and SC ($p = 0.456$) at different feedback format. Iconic feedback format dominated higher mean scores compared to textual feedback format for both SQ (Mean= 4.521, SD= 0.654) and SC (Mean= 4.697, SD= 0.788) for male students. Female students scored similar mean scores in textual and iconic feedback format for SQ and SC.

Table 4
Results for gender with SQ and SC at different feedback format

SQ	Male			Female			Significance (p)
	n	Mean	SD	n	Mean	SD	
Textual	120	4.388	0.679	120	4.335	0.640	0.372
Iconic	120	4.521	0.654	120	4.356	0.785	
SC	Male			Female			Significance (p)
	n	Mean	SD	n	Mean	SD	
Textual	120	4.588	0.829	120	4.537	0.779	0.456
Iconic	120	4.697	0.788	120	4.532	0.974	

p=0.05

2 Result for research question 2

Question 2: Does internship exposure affect problem solving performance using online discussion board at different synchronicity and feedback format?

Multiway Analysis of Variance (ANOVA) is conducted to explore the effect of internship exposure with SQ and SC at different synchronicity.

Referring to Table 5, statistically, there were no significant result between internship exposure both SQ (p = 0.472) and SC (p = 0.740) at different synchronicity. Synchronous learning sessions dominated higher mean scores compared to asynchronous learning session. Post internship participated in synchronous learning session carried higher average score for both variables; SQ (Mean = 4.450, SD = 0.703) and SC (Mean = 4.638, SD = 0.891) compared to pre internship.

Table 5
Results for internship exposure with SQ and SC at different synchronicity

SQ	Pre Internship			Post Internship			Significance (p)
	n	Mean	SD	n	Mean	SD	
Synchronous	120	4.354	0.761	120	4.450	0.703	0.472
Asynchronous	120	4.396	0.669	120	4.401	0.634	
SC	Pre Internship			Post Internship			Significance (p)
	n	Mean	SD	n	Mean	SD	
Synchronous	120	4.565	0.956	120	4.638	0.891	0.740
Asynchronous	120	4.565	0.816	120	4.586	0.709	

p=0.05

Referring to Table 6, statistically, there were no significant result for internship exposure to both SQ (p = 0.264) and SC (p = 0.187) at different feedback format. Iconic feedback format scored slightly higher mean scores compared to textual feedback format for both SQ (Mean= 4.499, SD= 0.644) and SC (Mean= 4.689, SD= 0.788) for post internship students. Pre internship students scored similar mean scores in textual and iconic feedback format for SQ and SC.

Table 6
Results for internship exposure with SQ and SC at different feedback format

SQ	Pre Internship	Post Internship	Significance (p)
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	n	Mean	SD	n	Mean	SD	
Textual	120	4.372	0.632	120	4.352	0.687	0.264
Iconic	120	4.378	0.792	120	4.499	0.644	
SC	Pre Internship			Post Internship			Significance (p)
	n	Mean	SD	n	Mean	SD	
Textual	120	4.590	0.793	120	4.535	0.816	0.187
Iconic	120	4.540	0.975	120	4.689	0.788	

p=0.05

DISCUSSION

Different synchronicity did influenced quality and confidence of solutions proposed by students. Statistically, synchronicity interacts significantly with gender with synchronous learning session produced higher quality and confident solutions compared to asynchronous learning sessions. This result is influenced from the control environment and students are more motivated participate in discussions because they will have instant response (comments or feedback) from their group members in a short time (Hrastinski, 2008 and Jara, Candelas, Torres, Dormido & Esquembre, 2009). However, feedback format did not effect to problem solving performance between learners. Similar average scores are discovered between textual and iconic feedback format reflecting, textual or iconic non specific feedback (Voerman, Meijer, Korthagen & Simons, 2012) produced similar result to problem solving performance for learners.

Multiway ANOVA analysis is conducted to explore gender and internship exposure with problem solving solutions performance. Results stated, statistically significant on average scores between gender for SQ and SC, however there are no statistically significant with internship exposure to SQ and SC. Male students stated that the quality and confidence of proposed solutions are higher compared with female students in synchronous learning session; except for small different in female with slightly higher average score in textual compared to iconic feedback format in asynchronous learning session. Non significant results are also discovered for feedback format to gender and internship exposure. However, male and post internship students participated in iconic feedback format produced higher average score in quality and confidence of proposed solutions.

This study produced result that discovers significant different between gender with synchronicity of learning session for problem solving performance. Male dominated higher average scores for quality and confidence proposed solutions compared to female students in synchronous learning session. This result is supported from internship exposure, with post internship students at synchronous learning session produced slightly higher average score in quality and confidence with proposed solutions compared to pre internship students.

The results has suggested, the internship exposure among students did effect to quality and confidence of solutions proposed, however as suggested in Vygotskian, the level of experience on learners does not symbolized the quality of learners' performance. Scaffolds within supportive groups may occur at different level of academic qualifications and age. Reflective activity during learning session is encouraged based on reinforcement will encourage learners to maintain learning motivation (Modritscher, 2006). Thus, any type of feedback formats either iconic or textual are encouraged as a reflective activity tool based on high value of average scores on learners performance for both quality and confidence on proposed solutions during learning sessions.

CONCLUSION AND RECOMMENDATION

Communication and social interaction did affected significantly to learners' performance. Solutions quality and confidence proposed during collaborative learning supported by computer system affected most with synchronous learning session compared to asynchronous learning session. Marginal effects on average scores are discovered between all male groups or all female groups in collaborative learning on task performances. Male had slightly higher average score to the quality and confidence on proposed solutions as compared to female. Swenson & Strough (2008) discovered gender did not significantly affected with academic performance however all female group carried higher average grade point

average (GPA) score compared to all male group. Homogenous group neither male nor female differ significantly with collaborative learning, but Speck (2003) suggested group should gender-balanced consists with equal male and female member because communication styles for female are more focusing on maintaining the group while male are on completing the tasks.

Internship exposure is expected to affect with learners level of critical thinking and problem solving (Walker, 2011) parallel to their maturation in thinking skills. However, based on this study, there are no significant result to differentiate learners' performance during collaborative learning at any type of synchronicity and feedback format. Thus, this has reflected, internship exposure does not play significant role on group formation during collaborative learning.

Feedback during learning is assumed will motive participants to contribute more with comments or suggestion during discussions. Giving feedback assist learners to restructure their knowledge and support their metacognitive process (Hsieh & O'Neil, 2002). Thus, feedback during learning will create positive impact to learning performances. However, based on the study, type of feedback format either textual or iconic consisted with the same non-specific feedback statements create similar result to problem solving performance. Non specific feedback format does not affect significantly in problem solving performance because it does not focus to learning goal parallel with research stating using positive or negative specific feedback format will relates learners to their learning performances (Voerman, Meijer, Korthagen & Simons, 2012). This has reflected, any type of feedback format is suitable to be applied in online discussion board.

It is recommended to have symbiosis between male and female learners at any level of internship exposure and using any type of feedback format during collaborative learning because both produced high average scores for quality and confidence in proposed solutions.

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