Journal of Engineering Science and Technology
Special Issue on SIET2022, May (2022) 1 - 11

TO EVALUATE THE COLLABORATION COMPETENCY IN ENGINEERING EDUCATION BY USING COMPUTER SUPPORT COLLABORATION LEARNING (CSCL) METHOD

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Abstract

Collaboration competency in engineering education is receiving more attention and it shall be developed outside the traditional classroom or pedagogy. It is getting challenging to evaluate the effectiveness of the mentioned skills in the COVID-19 pandemic when online distant learning become one of the main approaches regardless the education course. Computer-Support Collaboration Learning (CSCL) method allow educator to evaluate the skills by using creative and innovation ICT tools and platform to conduct cooperative activities even without face-to-face classroom environments. The feature Insight of Microsoft Team and Private Channel enable student and educator to conduct group work and monitoring work respectively in a private and confidential virtual environment. Through the analysis data, it showed a significant outcome when group utilizing ICT tools during the group work. The result also showed the important of leaderships in an engineering group project and formative feedback and consultation of the instructor.

Keywords: Collaboration, Competency, CSCL, Engineering education, Online learning.

1. Introduction

Collaboration competency is one of the skills had been neglected in engineering education, yet it revealed the vital and essential skills through much research. It started to capture the attention of various national engineering board or agency, who accrediting the local engineering program, to include the competency as one of the engineering programs learning outcome for the graduators [1]. However, collaboration competency cannot be developed through classic and traditional classroom or exam-based assessment [2]. The competency can be empathized or delivery through simple group project or activity, but the factors of influencing collaboration competency of an individual remain unsure. The evaluation becomes more challenging when COVID-19 pandemic strike globally, and forcefully drives many institutions of higher learning to conduct all the teaching and learning activities online in an unprepared situation. New methods of assessing existing assessments in every learning programme of an institution are urgently to be studied and developed in order that the learning curve and process of learners will not be hidden. Collaboration or group activities in the online class can be easily neglected under such scenario.

Computer Support Collaboration Learning (CSCL) is not a new method during this pandemic, but it had been introduced and utilized to assist on enhancing in developing collaboration skills of the learner creatively by using Information Communication Technology (ICT). The objective of this research is to study and evaluate the collaboration competency of engineering student in term of leadership and perception by using ICT in a group project.

2. Literature Review

Utilizing technology to support teaching and learning started in the last 20 years especially in collaboration activity in institution of higher learning, and it bring great advantages for flexibility learning environment [3]. The method included social media, mobile device, which is the main platform for today [4]. CSCL is one of the method and approach to enhance the experiences [5]. Many apps ready ICT tools in the market is available included Google Docs [6], Google Drive [7], had been utilized. However, much research also developed new ICT tools to analyse the effectiveness of different collaboration activity in engineering and non-engineering course [8].

Besides CSCL as the method, Formative Assessment and Cooperative Work (FACW) another teaching methodology to promote collaboration activities through assessment by using peer support and feedback. Even though the outcome of the study did show the improvement of study effectiveness, however, through the questionnaire, students expressed teamwork was not the optimum way of learning theory and practical in engineering course [9]. Social network analysis (SNA) another similar approach of CSCL, where emphasizing on relational ties, multi-mode network as the major establishment and served as the support tools for CSCL. The result revealed that students able to engage a deeper level individual knowledge through interaction, group work [10]. The analysis models in the study had make further ensure the important of interaction, group discussion, mentorship in higher level of learning [11, 12]. The mentioned criteria continue to remain as one of the focuses in education in the post-COVID era and International Online Collaboration

Competencies (IOCCs), as one of the recent approaches. The evaluation framework is to emphasize on virtual and global teamwork development in higher education [13].

The two research questions of this analysis included:

1. What is the factor affected the collaboration engineering work for a quality of the work outcome by using CSCL?
2. What is the level of comfortable of engineering student to adopt ICT tool to carry out collaboration work?

3. Methodology

There are 31 students who participated in the project, it been given duration approximate 3 weeks (the demonstration date of each group was vary) to complete the assignment, which included prototyping, demonstration, and report submission (individual). The scope of the project is every group was freely forming their group of 5 (or 6) members and submit the name to the module lecturer. The purpose of forming small group learning is induce active learning, which was proven as one of the effective methods [14, 15]. Module lecturer divided group by using Microsoft Team as the digital tool and platform by setting Private Channel for each team. The purpose of using the mentioned digital tool is based on the criteria below:

1. Seamless assessment through web-based and apps platform.
2. Private Channel offer private and confidential (P&C) environment for group discussion and other activities.
3. Effective of virtual classroom management for module lecturer.
4. Microsoft Team offer Insight feature to perform activity analysis of each channel (group).

No group leader had been officially appointed or assigned. The objective is to evaluate the level of collaboration each member of the group in term of initiative, responsiveness during the whole project. This will be reflected through the post, reply, reactions, and online meeting time. Data collected for this activity was based on:

1. The recording time (to eliminate conversation does not contribute to the group project)
2. The number of meetings online by using Microsoft Team. Module lecturer had requested the student to use the virtual classroom tool to perform all the discussion and recorded it. The scope of this study will neglect the possibility of students use other communication platform and assumed all the discussion only performed on the mentioned platform.
3. The online meeting will not be included in the analysis if is showed only one participant. This is to ensure the data truly reflect the collaboration work and discussion was happening during the meeting.

The collaboration evaluation data was collected right after the demonstration of the group was completed and students were required to perform peer evaluation and feedback within the group. The evaluation only will be handed right after the demonstration and completed it within the given timeframe. The purpose is to collect an authentic and true feedback from the students toward their peer during the who collaboration work. This will reflect the perception of the students towards the effectiveness and level of acceptance of CSCL in this project [16].

4. Result And Discussion

The breakdown result showed in the Table 1 to reveal the quality of the work of all the groups after the module lecturer had assessed and evaluated.

Table 1. Result and outcomes.

Group	Project	Outcome (demonstration)
Group 1	Vehicle Bumper	Functional with Flaw but without assumption
Group 2	Sliding Train Door	Functional without Flaw and without assumption
Group 3	Gym Safety System	Functional without Flaw with minor assumption
Group 4	Piping Flow Control System	Functional with Flaw and major assumption
Group 5	Automatic Sprayer	Functional with Flaw and major assumption
Group 6	Scissor Lifter	Functional with minor Flaw and minor assumption

Only Group 2 and Group 3 able to present the functional prototype the group proposed, and without and with minor assumption respectively. The "assumption" is referring the prototype did not include the component been described in the proposal but manually drove the operation or mechanism during the demonstration. The result revealed that group with obvious leadership practice in a collaboration project is very important. None had been appointed official to be the group leader however, the quality of the product outcome is very different with an individual willing to take the rule to charge and initiate the direction of the project. The outcome fully agrees with the evaluation of digital collaboration skills, as leadership played as one of the important factors to have effective learning [17].

Brainstorming, discussion, or other collaboration activities by using ICT also played a major role. Forum-based discussion and online meeting not limited location and time zone for the collaboration work. Group 2 and Group 3 had fully utilized the system and platform and produced a high-quality outcome compared to other groups. The private channel created in the Microsoft Team is fully private and confidential (P&C), and all the content will not display to the other besides the group members. Group 2 and Group 3 had put the whole process of discussion and online meetings with recording in the channel. According to the member, it will be easy for the group to track the progress and milestone when the project still on-going.

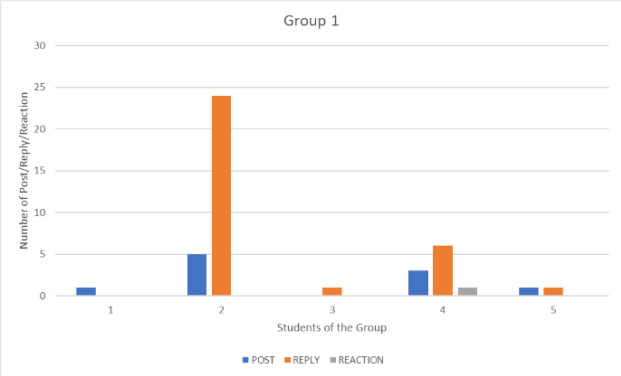
A good quality outcome of a collaboration work is not fully related with the perception and satisfying between members. From the survey, none of the groups rise the issue of uncooperative members but above satisfaction in working of the project. However, this does not guarantee a good and quality outcome of the product. True satisfaction in a team shall be reflected in spending time, which mean the feedback of groups with accumulated long hours online meetings and high responsive replies in discussion truly reveal the satisfaction level in the collaboration work.

In Table 2 and Fig. 1, the data showed the number of postings, reply and reaction of the groups for each member within. The data reflected and revealed how active a

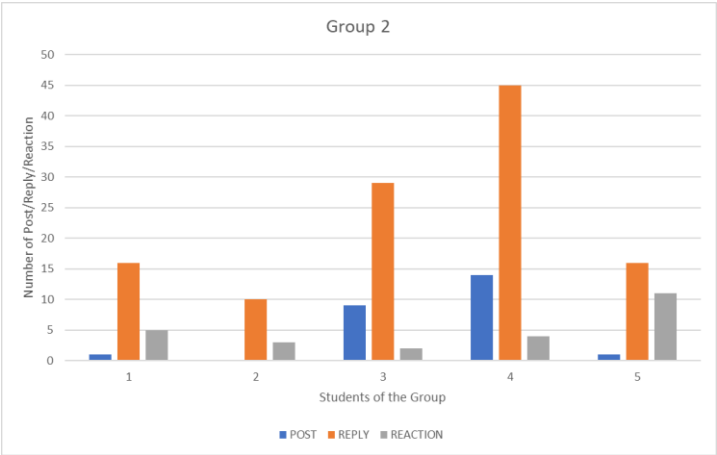
group to conduct brain storming, discussion, and the responsive level of it. The group having the highest active discussion will be Group 3 with 231 postings and replies, whist the lowest will be Group 6 with total 34 posting and replies.

Table 2. Number of posts, reply reaction of the group.

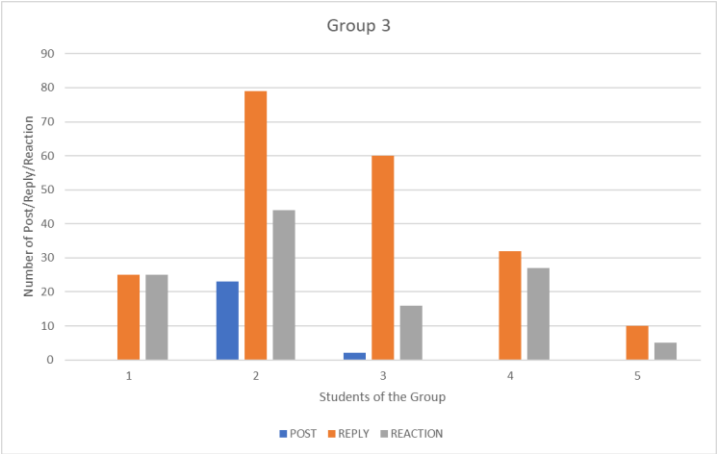
GROUP	POST	REPLY	REACTION
	1	0	0
	5	24	0
Group 1	0	1	0
	3	6	1
	1	1	0
	1	16	5
	0	10	3
Group 2	9	29	2
	14	45	4
	1	16	11
	0	25	25
	23	79	44
Group 3	2	60	16
	0	32	27
	0	10	5
	2	11	3
	2	8	0
Group 4	1	4	14
	11	60	23
	0	5	2
	1	5	4
	5	7	6
Group 5	0	8	3
	1	2	8
	1	7	6
	0	3	2
	3	8	6
Group 6	0	3	3
	0	2	3
	5	8	5
	0	2	2



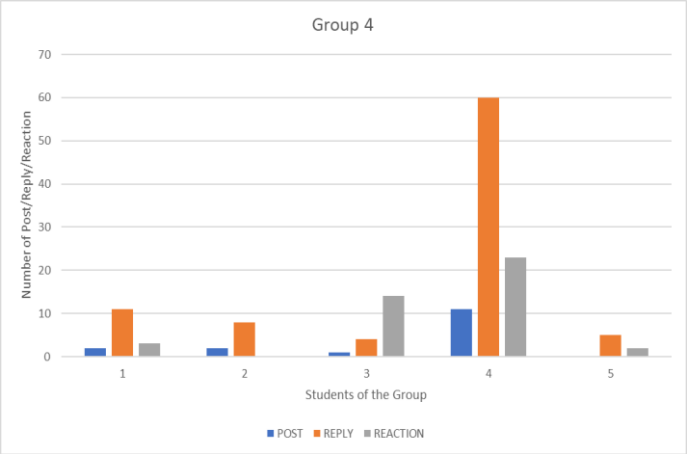
(a)


Group 2
Number of Post/Reply/Reaction
0
5
10
15
20
25
30
35
40
45
50
1
2
3
4
5
Students of the Group
POST
REPLY
REACTION

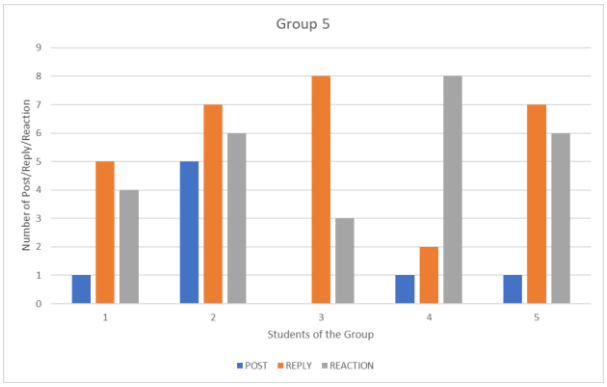
(b)


Group 3
Number of Post/Reply/Reaction
0
10
20
30
40
50
60
70
80
90
1
2
3
4
5
Students of the Group
POST
REPLY
REACTION

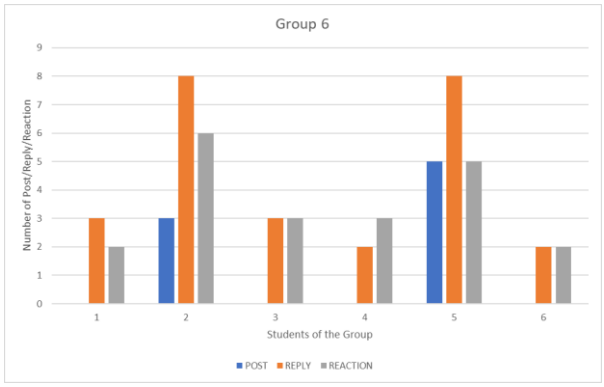
(c)


Group 4
Number of Post/Reply/Reaction
0
10
20
30
40
50
60
70
1
2
3
4
5
Students of the Group
POST
REPLY
REACTION

(d)



(e)



(f)

Fig. 1. The posting, reply and reaction of the groups, (a) Group 1; (b) Group 2; (c) Group 3; (d) Group 4; (e) Group 5; (f) Group 6.

Figure 2 showed the number and accumulating time (mins) of the respectively. Group 2 had the highest accumulative recorded online meeting time (mins) and number of conducted online meeting had been, which is 392 mins and conducted seven online meetings with average 56 mins/meeting. The second highest is Group 3, with 316 mins and conducted six online meeting, average 52.67 mins/meeting. The lowest conducting online meeting are Group 5 and Group 6, which only conducted one recorded online meeting and both only last for 11 mins in the meeting respectively.

Through the data, not only revealed the level of each group utilizing and adopting Microsoft Team as the CSCL, but it also as well showed the individual student who posted the most posting and make the most replies. The initiative displayed the leadership practice in each group. The obvious leadership been exercised and practiced included Group 2, 3 and 4. The three mentioned groups had the same common phenomena, there is one student who make the most posting and reply. For example, Group 2, Student 4 posted 14 posting and make 45 replies throughout the whole collaboration period. It can be concluded group with significant leadership able to drive and have clear direction working out the project

with good outcome [18]. On the other hand, Group 5 and Group 6 make lesser discussion through posting compared to the other four mentioned groups.

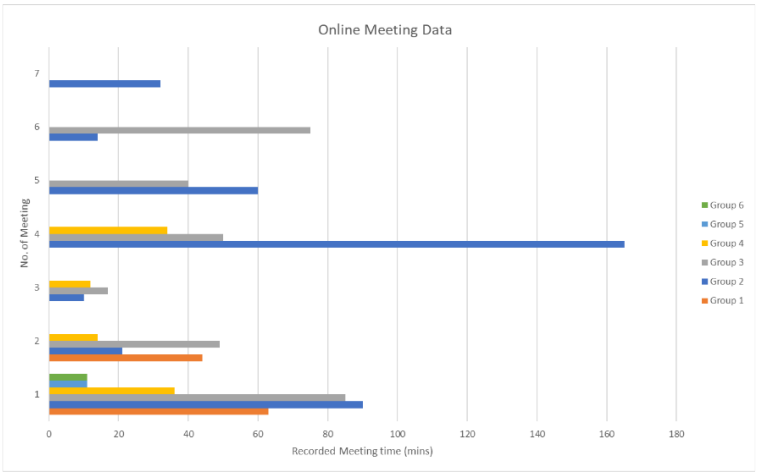
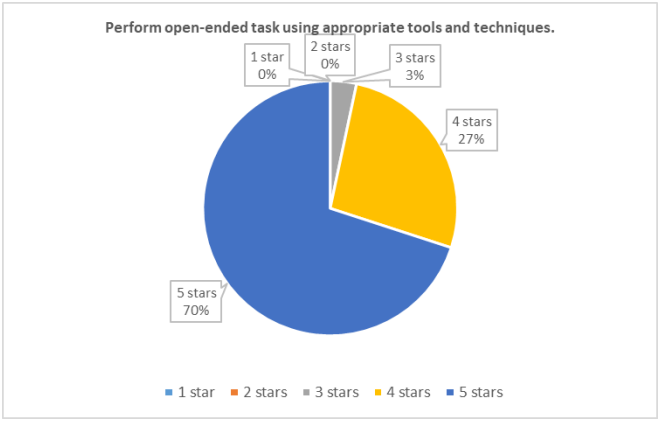


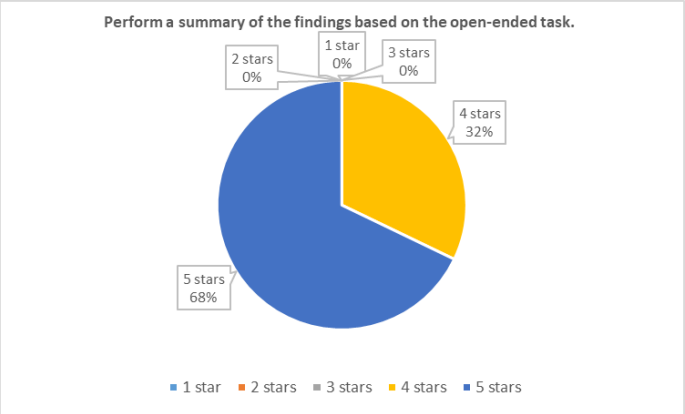
Fig. 2. Number of online meeting vs recorded time.

In the Fig. 3, it revealed that the working condition and equipment for the project is above satisfying, which is between 3 stars to 5 stars in various sections. This showed there are all students are comfortable with the CSCL working approach.

Consultation and advice, or formative feedback will greatly benefit the work of the group during the progress of the project. The analysis in Fig. 4 showed the highest consultation approach by tagging the module lecturer after posting a question is Group 6 (7 tags in private channel and 5 tags by students' personal message by using Microsoft Team chat). Even though Group 6 is one of the least having group posting and online meeting, however, the outcome of the project with minor flaw and assumption revealed formative feedback and consultation from instructor also enable the group product an above average outcome. The result agreed by the research conducted previously in formative assessment [19, 20].



(a)



(b)

Fig. 3. Overall feedback and peer review of the groups, (a) Perform open-ended task using appropriate tools and techniques; (b) Perform a summary of the findings based on the open-ended task.

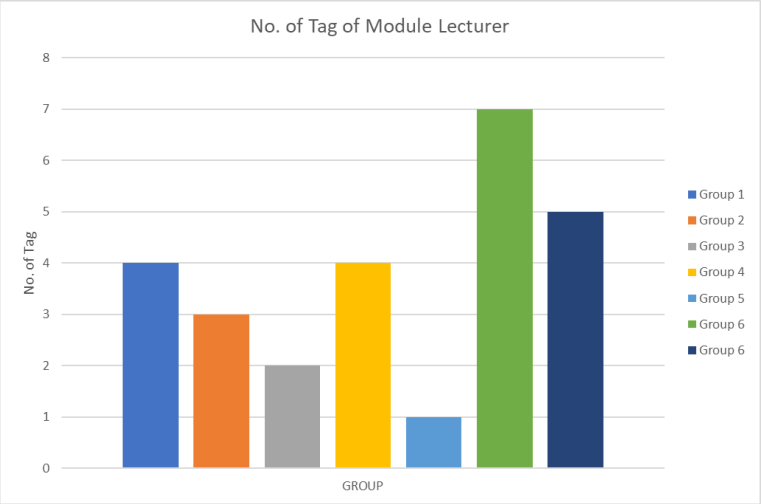


Fig. 4. Number of tags for module lecturer.

5. Conclusion

The Insight of Microsoft Team, as one of the common virtual classroom management systems, provided effective and practical analysis data to analyse the collaboration activities of a group project. The private channel provided a safe and secure virtual environment to carry out forum-based discussion, and online meetings and through the survey and feedback, every group were happy to work together without any issue, reflected the effectiveness of CSCL method. The analysis and study also revealed the important of leadership in the collaboration work to produce a quality and better outcome in engineering education. The leadership able to foster the other group members to adopt and adapt the CSCL, who may not totally used to perform the collaboration project in this manner.

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