

# Pattern of Interaction in Online Cooperative Learning: An Analysis of Communication Perspective

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## Article history

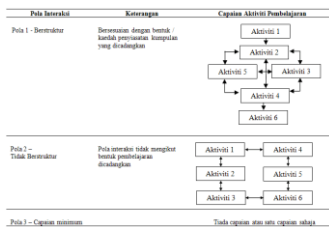
Received :5 February 2014

Received in revised form :

1 February 2015

Accepted :15 March 2015

## Graphical abstract



## Abstract

Communication is one of the generic skills needed by students in preparation for the career path. Cooperative learning supported by web applications has been identified as a strategy that can help students to improve their communication skills. The aim of this study is to identify pattern of interaction in an online cooperative learning (OCO<sub>L</sub>) that helps the communication skill aspect among students. A Learning Management System which is modified based on the principles of cooperative learning with the learning structure in accordance to the method of investigation group has been developed as a learning platform. It also serves as a data collection instrument. A group of 15 students were randomly selected to carry out six OCO<sub>L</sub> sessions which implemented using counterbalanced group quasi-experimental design. The results of quantitative and qualitative analysis of the log data showed two patterns of students interaction i.e. structured and unstructured pattern. The differences in pattern of interaction also influence students' focus on using interaction tools and the quality of discussion produced. The results of this study have implications for the structural design of OCO<sub>L</sub> that can assist students in communication aspect.

**Keywords:** Active learning; cooperative learning; online learning; communication

## Abstrak

Komunikasi adalah antara kemahiran utama yang perlu dikuasai oleh pelajar sebagai persediaan menghadapi dunia kerjaya. Pendekatan pembelajaran koperatif dengan sokongan aplikasi laman web dikenal pasti sebagai strategi yang mampu membantu pelajar meningkatkan tahap komunikasi. Kajian ini bertujuan mengenal pasti pola interaksi pembelajaran koperatif dalam talian (OCO<sub>L</sub>) yang membantu dari aspek kemahiran komunikasi. Sistem pengurusan pembelajaran (Learning Management System) yang diubah suai berdasarkan prinsip pembelajaran koperatif dengan struktur pembelajarannya mengikut kaedah penyiasatan kumpulan dibangunkan sebagai platform pembelajaran. Ia juga bertindak sebagai instrumen kutipan data. Sekumpulan 15 pelajar dipilih secara rawak bagi tujuan mengikuti enam sesi OCO<sub>L</sub> yang dilaksanakan berpandukan *one group counterbalanced quasi-experimental design*. Hasil analisis secara kuantitatif dan kualitatif ke atas log data terhasil mendapati dua pola interaksi dihasilkan pelajar, iaitu; pola berstruktur dan pola tidak berstruktur. Perbezaan pemilihan pola interaksi turut mempengaruhi fokus pelajar terhadap penggunaan alatan interaksi dan kualiti perbincangan dihasilkan. Hasil kajian ini memberi implikasi terhadap reka bentuk struktur OCO<sub>L</sub> yang dapat membantu pelajar dalam aspek komunikasi.

**Kata kunci:** Pembelajaran aktif; pembelajaran koperatif; pembelajaran atas talian; komunikasi

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## 1.0 INTRODUCTION

Education has an impact on the development of knowledge, skills, behaviours, attitudes, and values (Ozbek, 2005).

Communication process is one (1) of main activities in learning activities (Guleca and Macanb, 2014) which refers to the transfer of information between teacher - student and student -

student (Eftimie, 2013). Communication with several of resources and environment has been identified in building students' knowledge (Kolb, 1984; Papert, 1991; Laurillard, 1993; and Jonassen *et al.*, 1995).

However, there are difficulties in integrating the activities which encourage communication skill in the curriculum and the learning process, especially in engineering and technical subjects

(Baren and Watson, 1993; Hamidreza, Zaleha, and Yudariah, 2012).

This situation has a negative effect on students' communication skills and team work which needed by current working environments (Hamidreza, Zaleha, and Yudariah, 2012; Yasmin Mohd. Adnan, 2012).

Active learning had been suggested as an approach that help students to improve their communication and teamwork skills (Aller and Bafna, 2007; Kessulot, Gazi and Isman, 2008; Sahin, 2007). Then, cooperative learning is an active learning approach which emphasizes on active participation of students in group activities such as interaction, communication, and collaboration act as an important part of the learning process (Silberman, 1996; Felder and Brent, 1994). Implementation of cooperative learning will allows students to be active in a meaningful way to develop their potential and psychology experience (Johnson and Johnson, 1999).

Research by Suhaida Abdul Kadir (2002), Morgan *et al.* (2005), Coats (2003), Dugas (2008), Mandal (2009), Enfeng, Tianfeng, and Zuqin (2011) prove the effectiveness of implementing cooperative learning towards the development skills related to social interaction.

There are some disadvantages of conventional cooperative learning, such as student attendance problems (Kagan, 1992); learning time (Li, 2010); students get boring after a few sessions and noise during discussions (Irma Savitri Sadikin, Deddy Suryana, and Isti Siti Saleha, 2008); and incompatibility group members during face to face discussion (Suhaida Abdul Kadir, 2002).

To overcome these disadvantages of traditional cooperative learning, technologies have an answer as a solution, which has been identified to improve learning effectiveness (Roselli *et al.* (2002), Linn, Clark, and Slotta (2003), and Clark (2004) and also assist in developing of skills (Hamidreza, Zaleha, and Yudariah, 2012).

E-learning system is an approach that is often used as a support in learning process, especially in the aspect of communication. For example, the interaction tools which provide in e-learning system can be use to help learning process (Urea, 2012).

Communication in a learning process often refers to communication between teacher - students - students which are among the main elements that determine the effectiveness and the outcome of this learning process (Efimie, 2013).

According to literature review, the implementation of cooperative learning consist lot of communication and social interaction activities. Then, cooperative learning also encourage for information sharing and students discussion (Johnson and Johnson, 2003).

For all of this discussion and literature review, there are one(1) question arise, what is the design of the cooperative learning structures if it is implemented online cooperative learning (OCoL) and help students' communication skills at one(1) time?

This question led to the execution of OCoL on students to obtain a quantitative and qualitative data aimed at identifying learning pattern of interaction.

The identified pattern of interaction will be a guide in designing the structure of OCoL communication. This implies that educators can use OCoL as a learning strategy that helps students develop communication skills.

## 2.0 PROBLEM STATEMENT

Communication has an important role in learning, including online learning. Therefore, the structure of an online learning must be designed with elements that encourage communication and interaction.

The active learning approaches such as cooperative learning provide elements and principles which encouraging students to communicate and interact throughout the learning process.

But, from another perspective, how should cooperative learning be implementing via website? Can the same method (conventional approach) be applied in order to obtain the same effect?

This important issue must be discussed since website and e-learning system are parts of learning today. Teachers need to understand the pattern of communication and student learning interaction before implement any cooperative learning (Gillies and Boyle, 2009). This issue is compatible with the concept of Instructional Design Model R2D2 such as the consideration of the student's or end user opinion towards the end product (Willis, 1995).

## 3.0 METHODOLOGY

The objective of this study is to obtain online cooperative learning (OCoL) pattern of interaction that may help students in terms of communication.

The study began with design and develops websites that have principles and elements of cooperative learning (Johnson and Johnson, 1991; 1999) with group investigation method as a learning structure (Sharan and Sharan, 1994).

A total of 15 students from the Faculty of Education in one(1) of Malaysia higher education institution were randomly selected to attend OCoL class for six(6) sessions. These sessions was conducted in a quasi-experimental method (counterbalanced design) (Campbell and Stanley, 1963) (Figure 1).

Session(S)	S1	S2	S3	S4	S5	S6
Design	X <sub>1</sub> O	X <sub>2</sub> O	X <sub>3</sub> O	X <sub>4</sub> O	X <sub>5</sub> O	X <sub>6</sub> O

$X_1, X_2, X_n =$  Sessions of class  
 $O =$  Log or portfolio produced after session

Figure 1 OCoL implementation session

Log or portfolio of learning activities which generated after the implementation of OCoL session was analyzed quantitatively and qualitatively. Then pattern of interaction can be identified, which may help students in their communication aspect.

## 4.0 DATA COLLECTION INSTRUMENTS

These log or portfolios of OCoL refer to group assignment, individual task, self-assessment, discussions text, feedback and reflection on assignments (Johnson and Johnson, 1999).

### 4.1 Log of Website Usage

Pattern of interaction of this OCoL were gathered through website logs. It refers to the student's activities during learning sessions (Johnson and Johnson, 1999) which generated a few data such as user data, frequency of accessing these learning activities,

the use of interaction tools, text discussion, and learning reflection. Two (2) types of log data are obtained: the frequency of accessing these learning activities and learning structure which translate quantitatively to facilitate the analysis process.

**5.0 ANALYSIS**

**5.1 Analysis on the Effect of Using Website (Written Communication)**

Quantitative and qualitative analysis was used to identify the outcome of using website on the aspects of communication using the guidelines from Xu framework (2008).

The first step is getting the number of text chats, forum discussion, and writing assignments (Table 4).

The second step is to analyse the content quantitatively (Manning and Cullum-Swan, 1994; and Vannini, 2007) of each text chats, forum discussion, and writing assignments. Then categorized them into five (5) criteria according to communication (Thomas, 2005) and interpersonal (Johnson, 2006) using a guided framework of Thomas (2005), Gilbert and Dabbagh (2005) (Table 1 and 2).

**Table 1** Evaluation criteria on text chats and forum discussion

Criteria	Description
K1	Able to describe on related topic information or submitted tasks using his/her own words vividly in the discussion
K2	Share the information with minimum comment and description
K3	State the information without any comment / review
K4	Personal response or provocation tend to discussion
K5	Negative message in discussion or personal views that are not related to the discussion

**Table 2** Evaluation criteria on writing assignments

Criteria	Description
K1	Explain the information positively towards completing the group task
K2	Edits the existing information without adding any new information
K3	Writing that support existing information
K4	Put the information without any personal comment but toward completing given task
K5	Reflection and feedback that are not related to given task

**5.2 Analysis on Pattern of Interaction (Learning Activities)**

The pattern of interaction of learning activity was gathered by classified the usage of interaction tool into six (6) activities (Table 3). This Table 3 refer to group investigation method (cooperative learning).

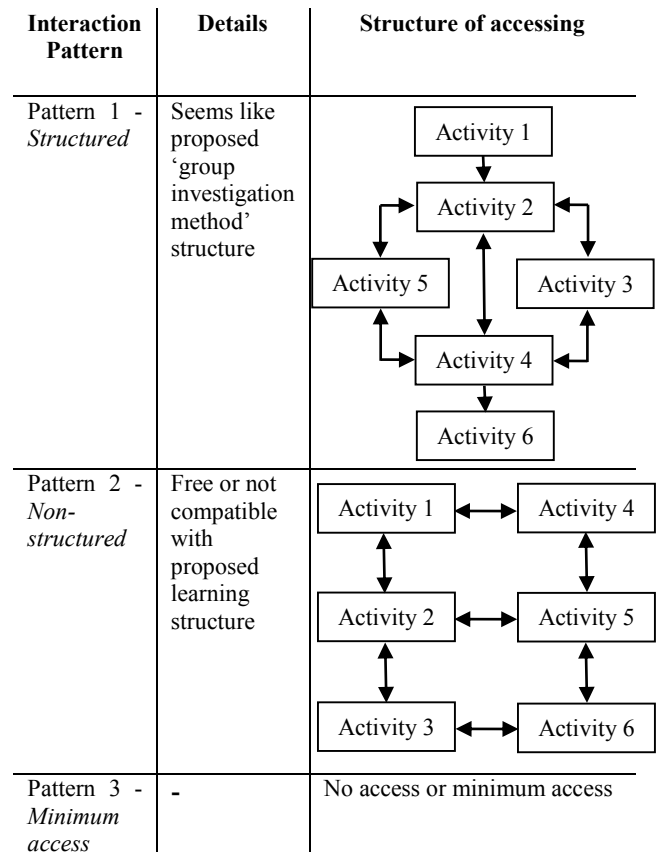
**Table 3** Classification of learning activities

Learning Activities	Access Method	Instrument
Introduction into subject (Activity 1)	<ul style="list-style-type: none"> <li>Introduction</li> <li>Understanding the learning process</li> <li>Group assignments / learning task</li> <li>Introduction to the assignments</li> </ul>	Assign group learning task using 'grouping tab' in Moodle learning system

Learning Activities	Access Method	Instrument
Finding & Reading Information (Activity 2)	<ul style="list-style-type: none"> <li>Finding and reading information</li> <li>Forum discussion</li> <li>Read the glossary</li> <li>Check the assignment</li> </ul>	<ul style="list-style-type: none"> <li>Provided notes</li> <li>Integrated search engine</li> <li>Accessing online forum and glossary</li> <li>Wiki tab</li> </ul>
Synchronous interaction (Activity 3)	<ul style="list-style-type: none"> <li>Real time discussion (chat room)</li> </ul>	<ul style="list-style-type: none"> <li>Chat room</li> </ul>
Information sharing (Activity 4)	<ul style="list-style-type: none"> <li>Introduction to the topic of discussion</li> <li>Add the glossary term</li> <li>Asynchronous discussion (online forum)</li> </ul>	<ul style="list-style-type: none"> <li>Chat room</li> <li>Private messages</li> <li>Online forum</li> </ul>
Reflection (Activity 5)	<ul style="list-style-type: none"> <li>Self-reflection</li> <li>Journal editing</li> <li>Journal review</li> </ul>	<ul style="list-style-type: none"> <li>Journal tab</li> <li>Self-reflection tab</li> <li>Learning feedback</li> </ul>
Group Assignment (Activity 6)	<ul style="list-style-type: none"> <li>Complete learning tasks</li> </ul>	<ul style="list-style-type: none"> <li>Wiki tab</li> </ul>

**5.3 Analysis on Pattern of Interaction (Structured Access Learning Activities)**

Classification of six(6) learning activities (Table 3) was used as a guideline to develop the pattern of the interaction in access structure of learning activities (Figure 2).



**Figure 2** Type of interaction pattern according to learning structure

6.0 FINDINGS

6.1 Quantitative Analysis; Text Chats, Discussion Forum, and Writing Assignments

All of the access logs i.e. text chats, forum discussion, and writing assignments (using Wiki tab) produced by each student are registered in a database system and then interpreted quantitatively as shown in Table 4.

Student	S1			S2			S3			S4			S5			S6			TOTAL		
	FR	CH	WK	FR	CH	WK	FR	CH	WK	FR	CH	WK	FR	CH	WK	FR	CH	WK	FR	CH	WK
P1	3	45	0	2	1	2	0	1	0	1	0	1	1	1	1	3	0	1	10	48	5
P2	0	61	1	6	20	0	0	0	1	22	1	2	22	0	1	3	0	10	128	2	
P3	2	18	1	1	3	1	0	13	1	0	2	1	19	1	0	9	1	4	64	6	
P4	2	19	1	7	3	1	3	6	1	3	5	1	5	10	1	0	0	20	43	5	
P5	0	29	0	0	22	0	1	9	1	3	1	1	0	1	0	0	0	2	64	2	
P6	4	27	0	1	14	1	1	6	1	2	7	1	2	25	1	0	15	10	94	5	
P7	2	7	1	0	7	1	0	30	2	0	7	1	0	4	1	0	0	2	55	6	
P8	2	14	1	1	15	1	2	8	1	12	2	0	0	0	1	1	1	0	7	50	6
P9	3	14	0	10	13	3	2	9	2	0	7	3	2	8	3	3	0	20	51	13	
P10	4	37	3	4	9	1	2	0	2	3	3	2	0	0	6	0	0	13	49	14	
P11	0	18	0	1	7	2	1	15	1	6	1	0	0	0	0	0	1	3	47	5	
P12	1	0	1	5	10	1	1	1	1	0	1	1	0	0	0	0	0	2	7	12	6
P13	1	4	2	0	2	2	0	29	1	0	0	5	0	0	0	0	0	2	1	35	12
P14	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
P15	3	73	0	1	1	1	1	0	10	1	0	3	1	0	0	1	0	5	87	4	
TOTAL	27	389	11	40	128	17	13	137	16	78	22	13	90	16	9	29	10	115	855	92	

FR = Forum; CH = Chats room  
 WK = Writing assignment at sharing text editing column  
 P1, P2, P3, P-N = Students

Quantitative analysis showed the highest accessing item is text chats over forum discussion and writing assignments during these learning sessions. A total of 858 text chats message

compared to 115 forum discussion and 92 writing assignments submitted during the learning session.

Analysis shows that there are differences in the quantity of each student's interaction with the tools. For example, P2, P6, and P15 showed the third highest number of text chats, but low on the forum discussion. While for students P4, P9, and P10 showed the third highest for forum discussion but low on text chats. Instead, students P9 and P10 showed high on writing assignments as well as high on forum discussion compared to other students. Thus, is there a correlation between forums discussion with writing assignments?

The findings of the quantitative analysis cannot be used as a main reference to determine the level of communication pattern of interaction instead a qualitative analysis is required in order to get a truth picture. Next, the discussion is about qualitative analysis to text chats, forums discussion, and writing assignments.

6.2 Findings of Qualitative Analysis; Text Chats, Forum Discussion, and Writing Assignments

Discussion in text chats, online forum, and writing assignments are recorded in a database for analysis. Each discussion is assessed (content analysis) on five(5) criteria. The analysis process and text chats are analyzed using content analysis method (Manning and Cullum-Swan, 1994) and (Vannini, 2007). Tables 5 and 6 (Appendix 1 and 2) are the details of qualitative analysis for each student on the three(3) communication tools.

Referring to Table 5 (Appendix 1), it showed that students P2, P6, and P15 have relatively good communication skill when using text chats. This finding is by referring that students are able to produce longer text charts compare to other students for criteria K1, K2, and K3 (Table 4).

However, text chats cannot be relied solely for assessing the level of communication. Therefore, evaluations are also being done on forum discussion. Table 5 (Appendix 1) also shows students P4, P9, and P10 communication level is top three(3) after analyzing the forum discussion. This finding refers to the number of forums discussion that are categorized as good (K1, K2, and K3), generated by those three(3) students during the learning session.

Based on these findings, forum discussion is more meaningful for learning purpose compare to text chats (George, 2011; Wishart and Guy, 2009; Mohan, Balasubramaniam, and Pararajasingam, 2010; Petty and Farinde, 2013). So, the focus of analysis is to looking up the pattern of interaction that generated by students in the forum discussions by category K1, K2, and K3. However, text chats is also used as a support for the analysis, since both of them have a positive effect on learning (George, 2011; Johnson, 2006).

Cross-references between Table 5 (Appendix 1) and 6 (Appendix 2) shows that P9 and P10 communicate on forums and produce writing task with good result. Table 6 shows that P13 only produce writing assignments which are evaluated better grade compare to other students.

6.3 Analysis of Individual Pattern of Interaction

Pattern of interaction in this research refer to accessing method or accessing structure of learning activities that use interaction tools provided in the website. Pattern of interaction gathered by analysis the usage of website performed by all students during learning sessions. The analysis then simplified by categorizing each log access to the six (6) learning activities and pattern of interaction (Table 3 and Figure 2).

Based on each of the student learning activities access log and pattern of interaction classification, analysis was to identify the students based on their pattern of interaction (Table 7).

**Table 7** Pattern of interaction of each student

Student	S 1	S 2	S 3	S 4	S 5	S 6	TOTAL		
							Pattern 1	Pattern 2	Pattern 3
P1	2	1	2	1	2	2	2	4	0
P2	1	2	2	1	2	2	2	4	0
P3	1	1	2	2	2	1	3	3	0
P4	1	2	2	2	1	2	2	4	0
P5	2	1	1	1	2	2	3	3	0
P6	2	2	2	1	2	1	2	4	0
P7	1	2	2	1	3	1	3	2	1
P8	2	1	1	1	1	2	4	2	0
P9	1	2	2	1	3	1	3	2	1
P10	3	1	1	1	3	1	4	0	2
P11	1	1	2	1	3	1	4	1	1
P12	1	1	2	2	3	1	3	2	1
P13	3	2	2	2	3	2	0	4	2
P14	1	1	2	1	3	2	3	2	1
P15	1	1	2	2	1	1	4	2	0
<b>Pattern 1</b>	<b>9</b>	<b>9</b>	<b>3</b>	<b>10</b>	<b>3</b>	<b>8</b>	<b>42</b>	<b>0</b>	<b>0</b>
<b>Pattern 2</b>	<b>4</b>	<b>6</b>	<b>12</b>	<b>5</b>	<b>5</b>	<b>7</b>	<b>0</b>	<b>39</b>	<b>0</b>
<b>Pattern 3</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>

According to Table 7, students learn more frequently through Pattern 1, 42 for Pattern 1, 39 for Pattern 2 and 9 for Pattern 3. Detailed analysis shows that majority of students in session 1, 2, and 4 tend to Pattern 1. But, after following learning session twice, the majority of students showed a tendency to follow Pattern 2 (session 3). Meanwhile during the final learning session, there is a balance of the number of students following the learning with Pattern 1 and 2. The majority of students follow Pattern 3 during fifth learning sessions, due to some of them involved in activities organized by the university, and therefore, students only want to complete the tasks.

The outcome of the detailed analysis include individual analysis, are used to see the correlation between interactions (quantity and quality) and pattern of interaction. Table 8 shows the details of individual analysis.

**Table 8** Pattern of interaction and communication level among students

Students	Tools	Number of Text By Criteria			Pattern Frequency		
		K 1	K 2	K 3	Pattern 1	Pattern 2	Pattern 3
P2	Text Chats	0	3	2	2	4	0
P6		0	6	2	2	4	0
P15		0	2	0	4	2	0
P11		0	0	3	4	1	1
P4	Forum Discussion	6	5	4	2	4	0
P9		5	6	1	3	2	1
P10		0	7	6	4	0	2
P9	Forum, Writing Assignment (wiki)	5,	6,	1,	3	2	1
P10		6	4	1			
P10	Writing Assignment (wiki)	0,	7,	6,	4	0	2
P13		4	6	0			
P13	Writing Assignment (wiki)	2	4	1	0	4	2

Table 8 shows the P2 and P6 who interact more in text chats (K2 and K3) were tend to follow pattern 2. As for P15 and P11 who interact (text chats) less, they were tends to follow a Pattern 1.

Students with the highest forum discussion (K1, K2, and K3 criteria) were found not tend to any specific pattern of interaction. Conversely, if can be attributed, P4 (forum discussion with K1, K2, and K3 criteria) tend to follow Pattern 2. Instead P10 (forum discussion with K2 and K3 criteria), tend to follow Pattern 1.

For P9 and P10 who are balanced on forum discussion and writing assignments, and are more likely to follow Pattern 1, they are also found to follow the learning with Pattern 2 and 3 respectively.

While P13 is more focused on writing assignments than interaction, most of his learning is Pattern 2 follow by Pattern 3.

The findings led to more discussions and related conclusions in the next section.

## 7.0 DISCUSSIONS AND CONCLUSIONS OF PATTERN OF INTERACTION TO COMMUNICATION

### 7.1 Overall Pattern of Interaction

According to analysis of pattern of interaction in this data analysis, it can be said that there are two(2) pattern of interaction which have no significant pattern from the communication perspective. For structured pattern of interaction, it is assumed the design, structure and learning guide affect students' interaction pattern. While for the unstructured pattern of interaction, it is assumed a constructive learning environment factors and web-based system that allows students to access freely any learning activity or any other website. Learning guide just an option to perform learning task, so learning structure depends on the convenience of students.

Moreover, the unstructured patterns of interaction occur because those students skip some of the provided learning activities, due to the structure of the website itself (Crooks *et al.*, 1998). The findings of Jamaluddin Harun (2004) also found that some students tend to follow an unstructured learning due to the structure of website that allows students to explore any learning activity freely.

### 7.2 Individual Pattern of Interaction

The results of the analysis in Table 8 show P2 and P6 (focus on text chats) and P4 (focus on forum discussion) are tend to Pattern 2. This finding led to the conclusion that the frequency of interaction and discussion within a group led to those students do not follow the prescribed learning structure.

Conversely, for P15 and P11 (less on text chats) and P10 (less on the forum discussion), showed a tendency to Pattern 1. This situation may explain the reverse, namely lack of dependency on interaction between a groups of students led to students are more comfortable following the guidelines provided.

As for P13, focuses on writing assignments resulting in following the structured learning less, thus indirectly interaction among the group of friends is also less.

The discussion here leads to the question of why are students with a structured interaction pattern is less prominent on the interaction (text chats and online forum)?

This question can also be attributed to interaction focus. Teixeira, Labid, and Nascimento (2002) describe pattern of interaction also can be seen from the aspect of frequency of access and interaction of students - students, student - teachers' interaction, and interaction within the system. In addition, the interaction pattern can also be seen in other aspects such as social

participation of students, interaction tools, and the level of discussion (Hara *et al.*, 2000).

Viewed from a different perspective, students who were less interactive (in this study) may be categorized into an individual interaction pattern (Esmond, 2009). Instead, collaborative interaction pattern is suitable for those students who are more interactive (Esmond, 2009).

A learning structure is designed as a guide for the implementation of learning. The structure of website that allows students to access any learning activity freely, enable students not to follow the provided guidelines (Crooks *et al.*, 1998; and Jamaluddin Harun, 2004). Therefore, students who perform learning accordingly on Pattern 2 cannot be assumed not following the lesson, but, they have their own learning style.

Based on the discussions and results of the survey, it can be summarized that each student has his own way of learning, not to mention learning via website which allows students to follow any learning structures. However, learning structure which refers to a specific interaction pattern can be used as a guide in improving learning achievement goals.

## ■8.0 IMPLICATIONS

The findings suggest several implications to the structural design of online cooperative learning. Although the findings and implications of this study have some similarities with previous researches, but it can be used as a guideline to achieve learning goals related to communication. Among the implications of this study are;

- i. The design of a learning structure plays an important role in promoting interaction and communication among students and reduces dependence on teachers.
- ii. The teacher's role by providing structured learning that requires students to interact with each others throughout the learning process.
- iii. Students have a full control on learning structure (website) and interaction tools.
- iv. Interaction in learning group plays an important role in helping students improve their communications skill.

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