

## The Pattern of Interaction in Online Cooperative Learning

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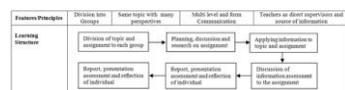
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### Graphical abstract



### Abstract

Online Cooperative Learning (OCO) provides a different experience compared to Conventional Cooperative Learning (CCoL). The implementation of OCoL uses various web-based tools to support elements of Cooperative Learning such as face to face interaction. This study looks into the patterns of interaction on OCoL using group investigation as learning method. A Learning management system namely Moodle (LMS) was chosen as a platform to run this OCoL. A group of 15 students from one of the academic programmes at one of our local universities were selected randomly to carry out six learning sessions using OCoL. OCoL learning activities are classified into: learning activities, use of interactive tools, and structure of learning to facilitate the process of analysis. A pattern of interaction was identified through quantitative and qualitative analysis of log data in usage of OCoL through six learning sessions which recorded automatically. Several patterns of interaction were identified and classified by learning session, learning structure, and number of access. Analysis found that students showed a high number of accesses in the early learning session, but this number decreased at the middle and final learning session which students tend towards individual activities such as information searching as well as group investigation method. The results of this study proposes a set of guidelines of design and implementation of online cooperative learning and also learning management system which is widely used as e-learning system in higher education institution.

**Keywords:** Cooperative learning; online cooperative learning; group investigation method; pattern of interaction

### Abstrak

Pembelajaran koperatif dalam talian (Online Cooperative Learning, OCoL) memberikan pengalaman berbeza berbanding pembelajaran koperatif konvensional (Conventional Cooperative Learning, CCoL). Pelaksanaan OCoL memanfaatkan pelbagai alatan interaksi berasaskan laman web bagi menggantikan elemen pertemuan bersemuka sebagai mana CCoL. Kajian ini melihat pola interaksi OCoL dengan aktiviti pembelajaran mengikut kaedah penyiasatan kumpulan yang dilaksanakan menerusi sistem pengurusan pembelajaran (learning management system, LMS). Sekumpulan 15 pelajar satu program pengajian di salah sebuah universiti tempatan dipilih secara rawak bertujuan bagi mengikuti 6 sesi OCoL. Aktiviti pembelajaran OCoL diklasifikasikan mengikut aktiviti pembelajaran, penggunaan alatan interaksi dan sokongan maklumat serta struktur kaedah penyiasatan kumpulan bagi tujuan memudahkan proses analisis. Pola interaksi dikenal pasti menerusi analisis kuantitatif dan kualitatif kepada log data penggunaan OCoL pada 6 sesi pembelajaran yang direkodkan secara automatik. Beberapa pola interaksi dikenal pasti yang boleh diklasifikasikan mengikut sesi pembelajaran, struktur capaian dan kekerapan capaian. Analisis mendapati pelajar menunjukkan kekerapan capaian yang tinggi pada peringkat awal pembelajaran tetapi semakin menurun pada peringkat pertengahan dan akhir pembelajaran. Seterusnya pelajar lebih cenderung kepada aktiviti mencari dan membaca maklumat dengan pelaksanaan pembelajaran mengikut kaedah penyiasatan kumpulan. Hasil kajian mencadangkan panduan reka bentuk dan pelaksanaan pembelajaran koperatif dalam talian dengan LMS yang banyak digunakan sebagai sistem pembelajaran elektronik institut pengajian tinggi.

**Kata kunci:** Pembelajaran koperatif; pembelajaran koperatif dalam talian; kaedah penyiasatan kumpulan; pola interaksi

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## ■1.0 INTRODUCTION

Cooperative learning refers to the cooperation of a group of individuals towards the same objective which they wish to attain by way of positive dependency (Hill and Hill, 1990). This cooperation was seen by McConnell (2000) as a collaborative process in completing group assignments given, which usually involves activities with social interaction in groups of 3 to 5 individuals. This cooperative learning activity is not only limited to the classroom, but extends to any group activity aiming to achieve a lesson objective such as to complete an assignment or fieldwork. Cooperative learning needs structure to ensure that social interaction occurs with each student being responsible for his own learning and also for helping the learning within the group (Patel, 2013; Gillies and Boyle, 2010; Cornelius-White and Harbaugh, 2010).

### 1.2 Problem Statement

Literature review has found that traditional teaching methods provide little help towards improving generic skills as well as making the students passive towards learning (Siti Rahayah Ariffin *et al.*, 2008; Rodiah Idris, and Nur'Ashiqin Najmuddin (2008). Rondon *et al.*, 2013; Deshpande and Huang, 2009; Razi *et al.*, 2014; George, 2011; Sadiyah Baharom, 2013). A student's passive attitude towards learning will have a negative effect on the graduate's ability to master generic skills (Palm and Bisman, 2010).

As a result, there arose the issue of unemployment especially amongst the graduates of the Social Science, which is linked to the graduates' weakness in mastering skills such as communication and cooperation (Noor Azina Ismail, 2011; Rahmah Ismail, 2011; Muhammad Hazrul Ismail, 2012; Sharifah Farhana Syed Othman, 2012; Kamalularifin Subari *et al.*, 2013; Zaliza Hanapi and Mohd Safarin Nordin, 2014).

As a suggestion, an active teaching and learning (T&L) approach could be implemented at tertiary levels with the aim of helping these students improve their mastery of generic skills which are most needed in the job field. Active learning can be provided by referring to the theory of constructive learning where students are required to have passive interaction to build their own knowledge (Hazzan *et al.*, 2011; Pinheiro and Simões, 2012; Alex, 2012; Drake, 2012).

Further, cooperative learning was a method of learning that focuses on social interaction as means to build knowledge can help increase mastery of communication skills and the degree of group cooperation amongst students as will be required within the working environment (Baghcheghi *et al.*, 2011; Wang, 2014; Jing *et al.*, 2011; Millis, 2010).

The e-learning system which is most used to support the process of T&L in classrooms, is seen as an attraction to enhance the effectiveness of implementation of active learning. For example, one of the active learning approaches which is cooperative learning can be made more effective with the support of web based technology (Rohaini Ramli, 2010; Soon and Umar, 2010; Huang *et al.*, 2012; Huang *et al.*, 2011).

Therefore it will be advantageous if the T&L process for Social Sciences subjects could adopt the approach of active learning with technology support, to help increase the mastery of generic skills that are needed by the working environment. Hence, a study in the format of survey, design, development and assessment was carried out to see how online cooperative

learning can help students from the Social Science stream improve their generic skills which are: communication skills, writing skills, group cooperation, and usage of websites. To support an online cooperative learning, a website was developed based on R2D2 instructional framework model (Willis, 1995). At the same time, the views of students, online education experts, and the subject lecturer, were also considered in the design of framework and development of website.

The production of a website used the instructional design model, the R2D2 model (Willis, 1995) as a guide to the design development assessment and implementation.

Then, the learning implementation was repeated at specific intervals to assess the efficacy of the learning especially from the aspect of improving the students' skills of writing communication and cooperation. Data produced during the online learning was classified into patterns of interaction and learning structure aimed to identify the form of cooperative learning. This method, also known as data mining, is proposed to identify the pattern of online learning for each student (Llorente and Morant, 2011).

## ■2.0 LEARNING IMPLEMENTATION

Learning implementation commenced with the setting up of a structured website and learning content design appropriate to a constructive learning environment (Jonassen, 1998), cooperative learning (Johnson and Johnson, 1991; 1999), group investigative methods (Sharan and Sharan, 1994) and online learning guideline (Salmon, 2000; 2002). For the purpose of developing website, the R2D2 Instructional Model (Willis, 1995) was taken as the principle and guide in the development process.

### 2.1 Learning Structure

The implementation of group investigative method with reference to the learning process structure in this study is summarised in Figure 1.

### 2.2 Learning Activities

The implementation of the group investigative method into learning activities which was made based on the students' access to learning support tools provided by the website. Although the group investigative method has six learning structures (see Figure 1), learning activities were adapted to the ease and usability of the developed website. Table 1 shows the learning activities provided at the website, which refer to the forms of access and usage of website tools.

## ■3.0 PATTERN OF INTERACTION

Based on the formation of six learning activities (see Table 1), three types of patterns of interaction were created and adapted to the group investigative method. Based on the group investigative method (see Figure 1) and learning activities (see Table 1), three patterns of interaction were formed as in Table 2:

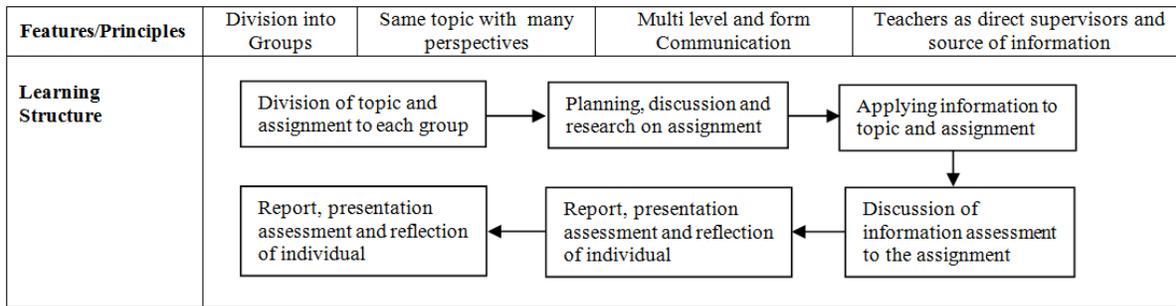


Figure 1 Features and structure of group investigative method

Table 1 Classification of learning activity

Learning activity	Type of Access	Tools
Beginning of learning (Activity 1)	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Understanding learning process</li> <li>• Distribution/receiving work</li> <li>• Introducing and understanding assignment</li> </ul>	Allocation of assignment using grouping application in Moodle learning system
Finding and reading information (Activity 2)	<ul style="list-style-type: none"> <li>• Finding and reading information</li> <li>• Reading forum</li> <li>• Reading glossary</li> <li>• Reviewing work</li> </ul>	<ul style="list-style-type: none"> <li>• Provided notes</li> <li>• Integrated search engine</li> <li>• Forums and glossary</li> <li>• Wiki</li> </ul>
Direct interaction (Activity 3) Sharing information (Activity 4)	<ul style="list-style-type: none"> <li>• Interaction using text conversation tools</li> <li>• Starting topic of discussion</li> <li>• Adding to glossary</li> <li>• Writing in forums</li> </ul>	<ul style="list-style-type: none"> <li>• Chat box</li> <li>• Forum</li> <li>• Private message</li> </ul>
Learning reflection (Activity 5)	<ul style="list-style-type: none"> <li>• Answering self-reflection question</li> <li>• Editing/ addition to journal</li> <li>• Journal revision</li> </ul>	<ul style="list-style-type: none"> <li>• Journal</li> <li>• Self-reflection column</li> <li>• Learning feedback / input</li> </ul>
Group Assignment (Activity 6)	<ul style="list-style-type: none"> <li>• Completing assignment</li> </ul>	Wiki

Table 2 Types of patterns of interaction based on access structure

Pattern of Interaction	Details	Pattern of Learning Activity
Pattern 1 - Structured	In line with the form or method of group investigation suggested	<pre> graph TD     A1[Activity 1] --&gt; A2[Activity 2]     A2 --&gt; A4[Activity 4]     A2 --&gt; A3[Activity 3]     A4 --&gt; A5[Activity 5]     A3 --&gt; A5     A5 --&gt; A6[Activity 6]             </pre>
Pattern 2 - Unstructured	Pattern of interaction did not follow the suggested learning format	<pre> graph TD     A1[Activity 1] &lt;--&gt; A4[Activity 4]     A2[Activity 2] &lt;--&gt; A5[Activity 5]     A3[Activity 3] &lt;--&gt; A6[Activity 6]     A1 --&gt; A2     A4 --&gt; A5     A3 --&gt; A6             </pre>
Pattern 3 - Minimum access		No access or only one access

#### ■4.0 LEARNING IMPLEMENTATION

A group of 15 students of the Faculty of Education, Universiti Teknologi Malaysia (UTM) were selected to follow the OCoL that had been developed. The Quasi-experimental method (counterbalanced design) of one group (Campbell and Stanley, 1963) was used repeatedly over six learning sessions (using website) and at the same time, students produced portfolio which could be assessed from the aspect of patterns of interaction. The repeat of learning over 6 times allowed for a continuous comparison of patterns of interaction to be made. The design of implementation and repetition of learning produced the pattern of interaction data as shown in Figure 2.

Session (S)	S1	S2	S3	S4	S5	S6
Design	X <sub>10</sub>	X <sub>20</sub>	X <sub>30</sub>	X <sub>40</sub>	X <sub>50</sub>	X <sub>60</sub>

Figure 2 Design of OCoL implementation

#### ■5.0 FINDINGS

##### 5.1 Interaction Pattern - Frequency of Access

The access logs of these 15 students were assessed by compiling and classifying the form of website access into 6 six learning activities (see Table 1) and are based on frequency of access (see Table 3).

Table 3 Frequency of learning activity access in each session

Learning Activity	Learning session						Number of access
	S1	S2	S3	S4	S5	S6	
Finding and Reading Information	138	143	89	89	66	88	613
Beginning of learning	64	44	37	47	28	62	282
Learning Reflections	53	47	36	47	21	42	246
Direct Interaction	39	59	20	24	17	14	156
Information Sharing	27	54	20	24	17	14	56
Group Assignment	20	25	25	27	14	27	138
<b>Total</b>	<b>341</b>	<b>372</b>	<b>238</b>	<b>268</b>	<b>175</b>	<b>252</b>	<b>1646</b>

The most frequent activity in the search and reading information can be related to the concept of learning that is, the process of getting information for the purpose of translation into knowledge. The second most frequently accessed activity which is the activity of commencement of learning indirectly shows that the student were revising repeatedly and further, understanding the process and guideline of learning including to identify assignment. The findings above show that the students require constant guidance in the learning process, especially in the case of websites where students are not able to interact or be face to face with the lecturer. In addition, the student also gave individual feedback and learning reflections via reflective questions and individual personal journals. It can be understood that some of the information obtained by the students are reflected into the private journals.

Real time interaction will allow discussion, motivation, response and provocation to exist in building cooperation within a group learning process. A real time interaction is important to act as continuous support to learning even though it may produce less what is considered as meaningful interaction.

Initially (S1 and S2), the majority of students followed learning activities such as adjustment of group investigative method (Pattern 1) with the assumption that at the initial stage, students needed to adjust to the set structure of learning. This is in line with Salmon (2002) which stated that online learning requires students to be used to the form of learning being applied. It was found that a small number of students followed

learning with Pattern 2 at the initial stage of learning. This finding is not against the concept of cooperative learning and is in fact in line with the concept of online learning, which is that the students are free but remain accountable for their own learning. Whereas the absence of students in Pattern 3 after S1, except at S5 is assumed due to students took the view that learning with Pattern 3 would not result in meaningful learning. This explains why real time interaction received a high amount of access as compared to information sharing, although conversely analysis has found that information sharing activities led to more interaction which was meaningful and beneficial to learning. Learning assignment activities received the lowest access as students would have had to complete the assignment after following the other learning activities previously discussed. As a whole, learning activities displayed a pattern of students having more real time interaction and information sharing at the beginning of the learning session as compared to the end of the session, where students were more focused on completing their learning assignments.

##### 5.2 Pattern of Interaction – Access Structure

The data of each student's access for each sessions (refer to Figure 2) were then analysed according to patterns of interaction (refer to Table 3) and led by learning activities (see Table 2). The result of the analysis was that several patterns of interaction were created according to the learning session (refer to Table 4).

**Table 4** Number of students by interaction pattern in each session

Pattern of Interaction	S1	S2	S3	S4	S5	S6	Total
Pattern 1	P2, P3, P4, P7, P9, P11, P12, P14, P15 ( $\Sigma = 9$ )	P1, P3, P5, P8, P10, P11, P12, P14, P15 ( $\Sigma = 9$ )	P5, P8, P10, ( $\Sigma = 3$ )	P1, P2, P5, P6, P7, P8, P9, P10, P11, P14 ( $\Sigma = 10$ )	P4, P8, P15 ( $\Sigma = 3$ )	P3, P6, P7, P9, P10, P11, P12, P15 ( $\Sigma = 8$ )	42
Pattern 2	P1, P5, P6, P8, ( $\Sigma = 4$ )	P2, P4, P6, P7, P9, P13 ( $\Sigma = 6$ )	P1, P2, P3, P4, P6, P7, P9, P11, P12, P13, P14, P15 ( $\Sigma = 12$ )	P3, P4, P12, P13, P15 ( $\Sigma = 5$ )	P1, P2, P3, P5, P6 ( $\Sigma = 5$ )	P1, P2, P4, P5, P8, P13, P14 ( $\Sigma = 7$ )	39
Pattern 3	P10, P13 ( $\Sigma = 2$ )	P5, P8, P10, ( $\Sigma = 3$ )			P7, P9, P10, P11, P12, P13, P14 ( $\Sigma = 7$ )		9
<b>Total</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>90</b>

Conversely with S3, the majority of students' preference changed to Pattern 2 with only three students remaining in Pattern 1 as compared to the previous sessions. This situation suggests that students did not prefer to follow the suggested learning process based on two previous learning sessions experience.

In S4, a majority of students revisited the website using Pattern 1 with all students retaining patterns of interaction from the previous sessions save for seven students who changed from Pattern 1 to Pattern 2 compared to previous sessions. It is suggested that the majority of students' experience in S3 which is based on Pattern 2 did not give as much positive impact on learning, and therefore a majority of students changed to Pattern 1 at S4.

After 4 sessions of learning using websites, the preference of the majority of students to website access shifted to Pattern 3. This does not mean that the majority of students were less interested in learning, but instead at S5, some students were involved in extracurricular activities which led to them having less time to follow the learning. However, the number of students following Pattern 1 and Pattern 2 still exceeded the number of students in Pattern 3 which indirectly allowed data collection.

At the end of the learning session, it was found that the number of students in Pattern 1 and 2 are balanced, with a ratio of 8:7. This situation suggests that the experience of following website-based learning over five times resulted in students being more focused towards completing their assignments without first carrying out the learning activities provided such as interaction, sharing information and learning reflection.

## 6.0 DISCUSSION

### 6.1 Discussion on Patterns of Interaction - Frequency of Access

A high frequency of access for the activity of finding and sharing information is seen as appropriate to the concept of active learning. An almost similar pattern of learning was also identified by Shi *et al.*, (2013), which is students are more focused towards reading and social interaction. It is said that reading is the main objective of learning with social interaction

being the way students learn in an e-learning environment. This finding shows that a substantial part of learning activities is concentrated on finding and reading information within a social environment. As the implication, online learning must be designed and structured to encourage students to find and read the information by socially interacting.

Group investigation method in the form of structured learning is considered to influence the students to make repeated revisions of the study guide especially at the beginning of learning. Indirectly it shows that at the preliminary stage of online cooperative learning, students need guidance on learning and as for this study, oral based explanation in the initial stages as well as printed guidelines.

The substantial information gained at the activity of search and read encouraged the students to produce a private journal to reflect information and learning. This clarifies why certain activities on learning reflection achieved lower access compared to that of searching for information. The findings may have been different if a different learning approach was used. For example, project based online learning showed the opposite where writing and analysis activities received the highest access compared to searching for project based data (Hou, 2010).

The higher frequency of real time interaction compared to sharing information shows that students require interaction support throughout the process of learning to allow sharing of information and discussion especially via forums. As an example, analysis of text conversations found that students will ask for help if they need information and this will be followed by sharing in the forum. It can be understood here that real time interaction is used to support learning while forums act as the main content of learning. This finding shows that there are various forms of interaction with different objectives within the same online learning process (Lee and Kim, 2012).

All these activities needed to be translated by the students by way of working together in completing their tasks, such as compiling information into an article. Each student is required to submit a sub topic which was earlier given to construct an article about the assigned topic.

Based on the above, in summary it can be said that the students' pattern of interaction in online cooperative learning is more focused on individual based activities such as information search, revision of assignment guidelines and learning reflection as compared to group type activities such as

interaction, sharing information and working together to complete the assignment

## 6.2 Discussion on Interaction Patterns - Structure of Access

The majority of students following learning with Pattern 1 at the early stage of learning shows that they follow the learning structure and guidance that has been provided. Such patterns of interaction can be said to be in line with the concept of familiarising the students with learning (Salmon, 2002).

At the intermediate level (S3), a majority of students were found to have followed the learning without following the set learning structure with the assumption that their experience with previous sessions had enabled a majority of them to go through learning without the guidelines, but be focused on individual based activities.

Conversely, at S4 the majority of students changed to learning within the proposed guidelines. As stated before, the students felt that going through the learning process without following the proposed guidance will give less results or will not achieve the objective of learning that was experienced in the previous session.

The majority of students with Pattern 3 at S5 showed that adequate time is required to implement online cooperative learning. Therefore, the majority of students' access is at a minimum and online learning cannot be carried out well. Knight (2013) states that amongst the factors of efficacy for cooperative learning is adequate time for each learning activity.

The ratio of students were similar at the end of the session, thus showing that repeating the same type of learning will allow a better understanding by the students of the learning structure and allow better focus on completing the assignment. This findings can be related to the high frequency of activities in completing tasks at S6 which can be summed up to be that the preference of students' for social interaction shifts to cooperation to complete the group assignment in the text editing and sharing column.

As a whole, a majority of students had learning based on the proposed learning structure especially at the initial stage of learning. This may be because the structure provided can help the students in the learning process and increase social interaction (Budenkova, 2012; Kupczynski *et al.*, 2012).

However, it was also found that those who followed learning without the suggested guidance can be connected to the students' freedom to access any learning activity. Besides, each student has his own way of learning.

## 7.0 SUMMARY AND IMPLICATION

Based on the data findings, discussion and conclusion, several factors are concluded to be the implication of the study:

- i. Implementing online cooperative learning based on certain learning methods especially that which is structure base, to allow students to follow it easily.
- ii. Various support tools for learning must be made available, whether in the format of social interaction support, information support, group cooperation support, personal space or learning reflection. This is because students will learn according to their own learning styles.
- iii. Learning guides must be provided as verbal explanation together with written guidelines. Lecturers should also act as an information source and monitor to the learning.

- iv. Students must familiarise themselves with online cooperative learning by repeated implementation at set period as well as at appropriate times of learning.
- v. Each student's feedback and learning activities for each session of learning must be assessed by the lecturer for the purpose of improving the next learning.

## 8.0 CONCLUSION

As a conclusion, it can be said that online cooperative learning must be conducted in a structured manner as a learning guide to students. Several methods of cooperative learning can be used without neglecting the five elements of cooperative learning. Guidelines whether in the oral/verbal form or printed form must be given throughout the online cooperative learning process together with the lecturer's presence as a source of information and supervisor of the learning. Online cooperative learning with several tools such as tools for interaction, sharing information, information support, text editing and sharing column, learning reflection and learning feedback. By way of support, learning guidance must be given as well as suggestion on implementation of the learning, but students may study according to their own style and comfort. Carrying out repeated learning has also been identified to be able to help students understand the process of online cooperative learning, however enough time must be set aside for the student to learn. In summary, it can be said that form, method and implementation strategy of learning is more important than the media or technology used which only act as learning support. It is hoped that the findings of this study can stimulate and trigger other researches especially in relation to specific learning methods with the latest technology support and thus to aid learning and teaching at university levels.

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