The Effectiveness of Collaborative Learning in Improving Higher Level Thinking Skills and Reflective Skills

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ARTICLE INFO	ABSTRACT
  	Collaborative learning (CL) is a 21st century learning approach that can improve thinking skills among students. CL strategies can improve motivation, understanding, communication and social engagement. This study attempts to evaluate the extent to which CL improves Higher Order Thinking Skills (HOTs) and reflective thinking (RT) abilities. This study involved 34 students in the final year of the bachelor's degree at the Faculty of Education, UTM who took the subject SPM4342 (Multimedia Based Multimedia Development). This study uses a qualitative methodology based on discussion forums and online portfolios for rubric content analysis. Analysis of the findings of the study shows that CL improves HOTs and RT abilities. Five groups out of 9 groups increased the level of thinking skills from higher to lower. When the 4 groups are in an environment of lower-level thinking skills and after being tested on the 4 groups, they are found to be inactive in the online-based CL While reflective skills increase from lower-level skills (Stimulated Reflection = 3.33% decrease and Descriptive Reflection I = 8.6% decrease) to higher-level skills (Descriptive Reflection II = 16.5% increase and Dialogic Reflection = 13.3% increase). In short, CL strategies can improve understanding and directly improve students' cognitive abilities.

1. Introduction

Internet and computer technology are widely used for various purposes, for example in the fields of medicine, commerce, education, industry, administration and so on. However, in the field of education the use of computer technology is increasing from time to time like a mushroom that is just growing. This is because there are many of the latest technologies that are suitable for use in the field of education. However, the selection of internet technology with the support of an appropriate learning approach must be emphasized so that the learning delivered is more memorable. This is especially to ensure that it is not only able to distribute information as needed but also supports students' thinking skills at a higher level. However, to support students' proficiency at a higher level, an appropriate learning approach must be chosen by the teacher in the Teaching and Learning (P &

P) process. Choosing internet technology with an appropriate learning approach can increase the effectiveness of learning in different ways, such as increasing interaction between students and teachers, enhancing student learning experiences, and providing flexibility to learn at anytime and anywhere are taken from [1, 2]. There are various strategies or approaches that may be used in the field of education to increase the standard of education for a country. However, as educators who have the responsibility to help the country reach a high level in education, they must use appropriate methods to increase the level of thinking of students. There are various strategies that can be used for T & T activities, for example, inquiry learning, collaborative learning (CL), project-based learning, problem-based learning, and so on.

1.1 Collaborative learning (CL)

Collaborative learning (CL) is a learning approach that encourages students to work together actively and productively. CL is an effective learning approach because it can encourage students to work together actively and productively in groups, and build social and cognitive skills such as communication, problem solving, and critical thinking are taken from [4, 5, 6, 40]. Through CL, students can work together to achieve learning goals and help each other help each other. CL approaches can also increase student understanding, develop social skills, problem solving skills and increase creativity and innovation among students. CL approaches can be designed either synchronously or asynchronously.

CL online approaches (either synchronous or asynchronous) promote human-computer interaction. The use of computers allows students to interact with peers in the teaching and learning process. CL approaches can create more active learning where students have their respective roles in the teaching and learning process. According to [7], CL encourages active learners and shows more enthusiasm in participating in CL activities. CL can encourage students to learn from existing experiences and adjust to the experiences of their teammates.

Therefore, this CL directly applies social constructivist theory and can increase their proficiency throughout the teaching and learning process. According to [8], CL can combine the experiences of the learner himself with other teammates to improve inquiry skills. The purpose of this study is to evaluate the extent to which online CL can improve higher-level thinking skills and reflective skills among students. In this study, qualitative methodology was used by using discussion forums and online portfolios for rubric content analysis. According to [3, 41], choosing the right learning approach can give a positive impression in the learning process because it can increase students' understanding, learning experience, and their initial knowledge.

1.2 Thinking Skills Among Students

Programs and practices in applying high-level thinking skills among students are an important agenda in the field of education. High-level thinking skills can help students understand the world around them more deeply and help promote lifelong learning are taken from [9-11]. Following this, many programs and practices were put in place to apply these skills to the T&L process. To carry out the program to apply these higher-level thinking skills in education, a detailed study must be carried out so that it can ensure the effectiveness of the learning strategies chosen by the teacher and can directly improve high level thinking skills among students.

Therefore, students must be taught about aspects of developing thinking skills rather than teaching exclusively for certain content so that it is in line with future needs [12-14]. The study found that students' deficient abilities in HOTs affected their achievements in Computer Science are taken from [15-18]. One of the high-level thinking skills that is often emphasized in learning is thinking

creatively and critically. According to [19], critical thinking is the ability to think reflectively which focuses on what certain individuals should do. Therefore, the ability to think reflectively is one of the higher-level thinking skills.

Reflective skill is a mental process that is used to fulfil a certain goal or to reach the expected decision. This is because, it is applied to gain a better understanding of ideas and is relatively unstructured and based mostly on emotional reprocessing of knowledge and understanding are taken from [20-24]. The importance of reflective skills in students is aimed at training students to respond and assess something individually or together to test the understanding of a learning process that is received more deeply. The purpose of reflective elements is necessary in students to train them to respond to thoughts and learn personally, share and collectively in the learning process are taken from [25-28]. The purpose of this study is to evaluate the extent to which online CL can improve higher-level thinking skills and reflective skills among students. In this study, qualitative methodology was used by using discussion forums and online portfolios for rubric content analysis. According to [3], choosing the right learning approach can give a positive impression in the learning process because it can increase students' understanding, learning experience, and their initial knowledge. The contribution of this study is for educators and students to see the effectiveness of online CL in improving students' thinking skills and reflective skills.

2. Methodology

This study uses qualitative methods based on content analysis. Content analysis is a useful method for social science investigations because it provides a systematic and objective approach to analyzing qualitative data. This method can be used to assess the level of students' thinking skills by analyzing answers or work results based on the assignments given. For example, investigators may analyze students' answers in written exams to identify the types of thinking skills they use such as classifying, interpreting, making inferences, evaluating, and so on. Content analysis can provide an overview of the level of students' thinking skills as a whole and help the teacher determine ways to improve students' thinking skills. This method can also be used to compare the level of thinking proficiency between different groups of students. Several steps in content analysis methods are firstly clearly outline what you want to achieve with your content analysis. Second, what are your research questions or objectives? Then, choose the material analysing and ensure it aligns with research goals. Next, create a coding scheme and develop a set of categories or codes that represent the key themes or concepts in the content (this is the backbone of the analysis.) Then, train coders (if applicable), if multiple people are involved, make sure they understand the coding scheme. Consistency is crucial for reliable results. After that, decide on the sampling strategy. Code the Content and apply the coding scheme to your content. This involves systematically categorizing or tagging different portions based on your predefined codes. After that, reliability checks for example if multiple coders are involved, check the reliability of your coding. Inter-coder reliability tests help ensure consistency. Content analysis is often an iterative process. Learn from your findings and consider how your approach could be refined or expanded in future studies.

The use of content analysis can provide information about the type and level of students' thinking skills used in a particular context are taken from [29-32]. It allows the investigator to identify patterns, themes, and categories in data, which can then be used to make inferences and make suggestions. This study uses content analysis rather than the use of discussion forums and electronic portfolios. According to [33], content analysis can retrieval experiments have shown that this representation provides good inferencing with very little decompression. The study sample used in this study

involved 34 students in the final year of the bachelor's degree at the Faculty of Education, UTM who took the subject SPM4342 (Multimedia Based Multimedia Development). Meanwhile, the type of probability sampling chosen in this study is cluster sampling. The reviewers chose this method because it was difficult to obtain a complete sampling frame for the purposes of this study. Therefore, the group sample was chosen because this study sample will represent the UTM student group who take web technology subjects at the Faculty of Education.

The advantages of group sampling are that it can be done in a large area and can reduce the cost of the study [34]. According to [35], group sampling can be used to reduce study costs and facilitate investigation administration. This study also conducts interviews with students to find out the level of thinking skills and reflective skills that have been achieved after participating in the CL. The sample for interview will also involve 10 students randomly. Interview session will be carried out to re-validate the content analysis data that was carried out. Interview Session is carried out directly and face to face and allows investigators to obtain information directly from respondents regarding experiences and views after participating in learning using this CL approach.

3. Finding and Discussion

Study findings related to the effectiveness of CL activities on high-level thinking skills and reflective skills based on the use of e-portfolios and discussion forums. After participating in designed CL, the reviewers analyzed the content in the use of e-portfolios and discussion forums to assess the effectiveness of CL on high-level thinking skills and reflective skills. to find out whether these designed activities have an impact on increasing high-level thinking skills and reflective skills among students. To analyze content using these discussion forums, the reviewer will automatically record student conversations and conversations through CL online. In addition, the texts and conversation transcripts will also be recorded for analysis by the reviewer to determine the effectiveness of this CL activity on high-level thinking skills and reflective skills among students. The reviewer will analyze the content of the rubric for using this forum according to the categories that have been selected based on the rubric designed by Smitha Mehta. Table 1 show coding scheme for reflective skill level based on the study of [36].

Table 1
Coding scheme for reflective skill level based on the study of Strampel & Oliver (2008)

Code	Reflective Skill Level	Description
SR	Stimulated Reflection	• Seeing something that doesn't quite fit. • Analyze how someone affects or is affected by a particular situation.
DesR I	Descriptive Reflection I	• Gathering and re-identifying an event.
DesR II	Descriptive Reflection II	• Interpret, classify, summarize, compare, and explain new information rather than previous knowledge.
DiR	Dialogic Reflection	• Analyze the situation critically, using existing knowledge. • Synthesize and integrate knowledge into personal knowledge.

CL activities involve nine groups of students. The reviewer tests a group of students because each web-based learning activity is carried out in a group that has been chosen by the students themselves. The analysis was carried out based on the level of RT and the level of cognitive processing as proposed by [36] following four stages, namely stimulus reflection, descriptive reflection, dialogic reflection, and critical reflection. Table 2 show the example of the content analysis based on reflective levels in discussion forums and e-portfolio.

Table 2
Content analysis based on reflective levels in discussion forums and e-portfolio

Reflective Skill Level		Description
Lower Level	Stimulated Reflection	• Does the icon itself have a navigation meaning? I mean the icon or button will navigate the user to where they want to go... • What I have written is true, but I think in this forum, we must discuss three aspects (organization, interactivity, navigation) in the three web pages. Maybe here we can make a comparison or equation. For now, I just shared views for two websites. Miss Akmal, you can read what I wrote and comment, okay...
Lower Level	Descriptive Reflection I	• On the Homepage, there is a Site Map link to make it easier for users to see the entire header along with the links contained in the "Thermo Collaborate" web page. Web page designers have included breadcrumb navigation to make it easier for users to track where they are. In general, breadcrumb navigation is as follows: Home page > Section page > Subsection page • According to constructivist theory, life experiences and natural events will cause humans to make assumptions and their own perceptions of the world besides paying attention to one's preparation for solving various problems (Mergel, 1998). Through this theory, students will be more inclined to form their own realities and interpretations and then adapt to these realities without depending on expectations from the teaching by the teacher and the teaching system.
Higher Level	Descriptive Reflection II	• This second web page is ok... simple. but it is less attractive when compared to the third web page in terms of the selection of themes. The colors used do not attract attention. This website is more student-targeted, so the theme colors used should be more cheerful and energetic to attract their interest and attention. • Hi buddiez, this is what I got from the discussion for the organization team. Organization is the way we manage/arrange/present our web page. Organization is important so that the website is neater, friendlier and more productive. The designed web pages must be organized in a logical order. From simple information to more detailed. For example, a website must start from the homepage/index/introduction first...then the content location. Do you have any questions for this organization? Later if I get other info I will post again.
Higher Level	Dialogic Reflection	• About the background of website, I think it is simple, nice but not attractive. But the website is also interactive in some way, such as when user move the cursor to the menu tab, the menu tab will change color. The cursor (arrow shape) will change to sursor (hand) when it rolls over a link, so user will know what can be click. • Suggestions: - use a dark text color (like black) if the background is a light color (like white); - put the video/animation on the required information/notes. The animation/video should be related to the content. Give leeway to web page visitors to play the animation/video itself (play, pause, stop, replay buttons).

The reviewer uses the code scheme proposed by [36] in analyzing students' RT stages as shown in table 1. The unit of analysis used in this study is the unit of meaning. The reliability that will be used in the analysis of the content of this unit of intent uses hundreds of agreements between several coders appointed by the reviewers. Rather than face-to-face discussion between the reviewer and an appointed coder, the percent agreement was 75%.
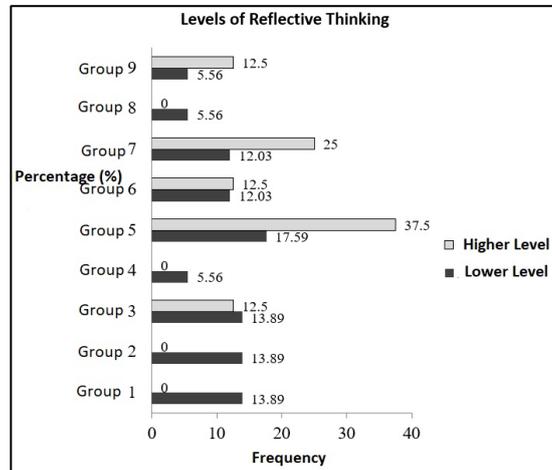

Fig. 1. Level of RT after Online CL Activity

Figure 1 shows five groups out of 9 groups increased the level of thinking skills from high to low. When the 4 groups are in an environment of lower-level thinking skills and after being tested on the 4 groups, they are found to be inactive in the online-based CL. According to [37] stated that CL can improve HOTs among students where they agree that collaborative learning can improve skills among students in the classroom. The results show that students who engage in CL are more likely to develop HOTs, such as the ability to critique and evaluate arguments, make decisions, and think critically.
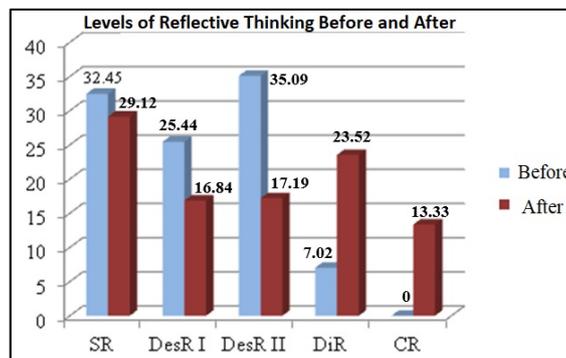

Fig. 2. Students' RT levels before and after participating in online-based collaborative

Figure 2 shows the results of a study of students' RT levels before and after participating in online-based CL. The results show that the level of RT for high levels (DiR and CR) increased after this web-based learning activity was carried out. Meanwhile, the level of RT for the lower levels (SR, DesR I and DesR II) decreased after web-based learning activities were carried out. According to [38], finding that CL can provide opportunities for students to consider the perspectives of their peers, encourage them to rethink their own thinking and consider new ways of seeing things (reflective skills). Furthermore, according to [39] stated that CL can help students gain deeper knowledge and improve their reflective skills through discussions with their classmates and the use of individual reflection.

4. Conclusions

In conclusion, there are many studies showings that online-based CL can improve high-level thinking skills and reflective skills among students. CL can provide students with opportunities to consider the perspectives of their peers, encouraging them to rethink their own thinking and consider new ways of seeing things. In addition, CL also allows students to build better reflective skills by considering the perspectives of their peers and exploring ways to solve problems in groups. With that, collaborative online-based learning can be considered as an effective learning method in increasing high-level thinking skills and reflective skills among students.

Acknowledgement

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