Iyer, S. et al. (Eds.) (2022). Proceedings of the 30th International Conference on Computers in Education.
Asia-Pacific Society for Computers in Education

The Effect of Online Collaborative Learning Environment with Integration of Technological Tools Towards Student's Achievement

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Abstract: Student performance after learning a topic is necessary to be achieved in school. Besides, teachers should have appropriate integrated teaching strategies to help students learn in class. Therefore, the purpose of this study is to investigate the effect of online collaborative learning that integrates technological tools for students' achievement in learning science. The impact of this study was measured by using an instrument called the Solar System Test to measure student achievement. This pre-experimental study was conducted on 30 Year 4 students from a school located in Johor Bahru, Malaysia. Descriptive analysis of the Solar System test showed that there was a significant difference between pre-test and post-test. The result proved that this research had positive impact on student achievement. In conclusion, this research helps teachers to develop an effective as well as a meaningful teaching and learning process, which is through the implementation of the 21st Century learning approach with the integration of technology tools in the teaching and learning environment.

Keywords: collaborative learning, achievement, technological tools, online learning

1. Introduction

Education in Malaysia promotes Higher Order Thinking Skills (HOTS) to diversify the learning environment. Higher Order Thinking Skills are the abilities of students to make use of knowledge, and skills in making reasons, solving a given task, and creating something new based on findings (Ministry of Education, 2013). The need for science environment learning will depend on many factors, such as the need of students and the characteristics of the science programme (National Research Council, 1996). For the past two decades, online learning and teaching can enhance students understanding of science and promote a good learning science environment. Nowadays, online learning can be an educational platform for teachers and students to learn (Allen et al., 2016).

To achieve this goal, the concept of online learning in science must be through proper design and effective utilisation of technology. The National Science Teachers Association (NSTA) defines online learning as an effective learning process created by combining digitally delivered content with learning support and services (Walter, 2001). Online learning should significantly enhance science teaching and learning and may be used to extend onside learning experiences.

Online learning is usually based on distant learning methods as online learning can be done while students and teachers are separated by distance. Online learning is when learning occurs by using a computer that is connected to the Internet (Vernadakis, 2011). Although online learning is not rigid to only

distance-based online courses or learning, the global pandemic that we are facing today has forced education to coop with the current situation. Online learning can also be used in traditional classroom instruction that incorporates the planned and effective use of collaboration with interactive digital tools and resources. Online learning can give many benefits to promote better understanding amongst students (Hashmatullah & Tahir Hanad, 2020).

Collaborative learning is defined as a learning method used for learning a certain topic by a group of students (Nevine & Rasha, 2015). Collaborative learning is when an individual works in a group and everyone is responsible to assist and contribute information about the topic (Moore and Kearsley, 2012). Online collaborative learning is important as it can promote students to work together actively and teachers act as an instructor during the online learning process (Hamalainen & Vahasantanen, 2011).

Recent research on online collaborative learning examined how the features of traditional collaborative learning such as intentional design, co-labouring of individuals, and meaningful learning were approached differently in an online course than in a face-to-face course (Barkley et al., 2014; Major, 2015). Moreover, integrating multiple technologies through education is a must nowadays. Due to the recent global health problem, heading on 21st Century education, the use of technology in education nowadays is crucial as students are familiar with these technologies and they can learn better since technology can assist them in learning. Integration of computer technology can enhance the effectiveness of teaching and learning process. It is right to say that almost all subject ranges from mathematics, science, languages, arts, humanity, and other major fields can be learned more effectively through technology-based tools and equipment (Ghavifekr & Ibrahim, 2015).

2. Literature Review

The use of a collaborative approach in teaching and learning and the integration of technology tools such as Google Classroom in online learning are discussed in this section.

2.1 Online Learning

The pandemic forces those in the education field to change the way in delivering information. From the conventional classroom environment, teachers and students are switching physical teaching and learning to online learning environments (Wu, 2020). The teacher is required to teach creatively and innovatively to provide students with proper education (Markus, 2020). Online learning can be defined as student learning experiences, either occurring at the time (synchronous) or learning at their own pace (asynchronous) after being given a task to complete by using various devices, such as laptops and tablets with the Internet connection (Dhawan, 2020). Online learning is capable of bringing students and teachers to communicate with one another regardless of background, location, and time (Venter, 2018). Online learning provides information to be updated instantly without the need to gather students in one place (Steven,2018). A study by Shivangi (2020) claimed that online learning is a platform that creates a teaching and learning process was more students centred. Online learning can be accessed by students independently anywhere and they still can interact with teachers and peers for sharing information (Singh & Thurman,2019).

Online learning is distance learning by using technology devices with Internet access to gain learning experiences (Dhawan, 2020). This research suggests two online learning approaches which are asynchronous learning and synchronous learning. Synchronous online learning is an approach when students and teachers attend live discussions such as online video conferencing that provide the teacher as facilitator and students to act as active participants (Lisa,2021). The synchronous learning environment provides instant interactions between peers and teachers and probably forms some quick feedback during the transition of online learning (Littlefield, 2018). Active interaction occurs in the synchronous learning environment (McBrien et al.,2009). On the other hand, asynchronous online learning gives a chance for students to come up with ideas and strategies in conducting information and delivering the knowledge (Pratt & Palloff, 2012). Sander (2019) stated that asynchronous online learning gave students to arrange their schedules and did not tie them to specific courses.

Other online learning approaches include interactive online learning, individual online learning, and collaborative online learning (Sander, 2019). The interactive online learning approach provides non-linear delivering information as students and teachers can share their knowledge, and experiences in a two-way communication with various types of methods. The interactive learning approach trains students in problem-solving and developing literacy skills directly without students realised (Urh et al., 2015). Nowadays, collaborative online learning has become a new type of learning that students can achieve in a group even not being in the same building (Sander, 2019). Collaborative online learning is a group of students working together to arrange and create knowledge and understand through online platforms to solve given problems (Bates, 2015). Good generalisation and creative ideas will occur by presenting the idea based on a collaborative online learning approach (Amy, 2020).

Online learning occurs when teachers and students did not meet in the same building. According to Sun and Chen (2016), effective online learning must have online content for teaching and learning, active participation and interaction between students and teachers and the use of online technology tools. This feature is needed to promote ongoing discussion effective teaching and learning even if the teaching and learning environment occurs virtually. In addition, online learning may promote self- confidence and develop students' authenticities (Wong, 2020).

2.2 Collaborative Learning

Collaborative learning is defined as when teachers and students collaborate in the learning environment to form group activities (Liaw & Huang et al., 2009). A study by Waleed et al. (2015) stated that collaborative learning consists of both active interaction and students' relation with the subject learned. Others stated that collaborative learning is a method used by a few students working together in groups to achieve learning objectives (Nevine et al.,2015). Emaliana (2017) stated that collaborative learning is a student-centred approach in making the action in the learning process while teachers act as facilitators to guide them.

The value of cooperation provides equal outcomes for each student. Second principles provide learning opportunities without looking at their backgrounds, providing better achievement as raw ideas come from various levels of students. Positive independence refers to the contribution of ideas that comes up from each participant in the group to solve a task. Individual accountability principles are the responsibility of each group to contribute ideas amongst others. Both simultaneous and equal participation is important as collaborative learning require all participants to be involved actively and not passively. Working together will help students to develop their collaborative skills. Teamwork in groups will improve interaction amongst group participants, which is an important part of a successful collaborative learning (Yildiz, 2017).

In this research, the principle of collaborative learning by Peter Brunn (2014) was chosen as the guideline to integrate technological tools to see students' collaborative skills and their achievements. This principle states four principles in conducting online collaborative learning. The principles are building a good convenient learning environment before starting a teaching and learning session. The second principle is that teachers must guide students to come up with their ideas, and prior knowledge so that students learn and gain information on the right track. Conducting a creative delivery will promote student communication with peers in group activities. Lastly, the teacher must give space for students to express their feelings and form their groups.

Collaborative learning is a common approach in teaching and learning. Hamalainen and Katja (2011) stated that with collaborative learning approach, it helps teachers to strengthen their pedagogical bases and build good student-centred activities. In collaborative learning, teachers foster students to build up positive responses and interactions (Anouchka & Jeroen, 2019). Collaborative Learning gives a new shape to the learning environment. Collaborative learning makes the learning environment more comfortable as they can share their ideas freely without boundaries and are not worried about their ideas being rejected (Michael & Hameed, 2017). A learning environment with the integration of collaborative learning gives students more motivation for learning better as they have teachers and peers to help them to achieve the learning objectives (Affendy & Ismail, 2019).

In a virtual learning environment, Affendy, and Ismail (2019) stated that a collaborative learning environment will allow students to perform discussions and complete other types of group tasks virtually without seeing anyone face- to- face. Research by Waleed et al. (2015) stated that the use of collaborative learning in online media can provide engagement amongst students. Furthermore, the use of an online platform makes the group task accomplish more quickly and the result is of better quality than the individual work.

2.3 Technological Tools

Technology tools are described as equipment based on computers and the Internet that connect to deliver services such as information, communication and so on (Gupta, 2017). Technology tools also can be defined as electronic devices that can be used for gathering information, providing communication for the institution, organisations and many more (Ameen et al., 2019). Teaching and learning by using technology usually involve hardware devices such as laptops, computers, tablets, phones and so on (Ameen et al.,2019). Other than that, online platforms for creating teaching and learning environment are also necessary (Nina et al, 2017). Without a suitable online platform, the teaching and learning process will not occur.

Technology tools can use online recording so that teachers and students can give appropriate feedback based on given response (Yoshida, 2016). Furthermore, online recording can avoid students from losing important information, and they can refer to the recording multiple times without worry (Yoshida, 2016). Besides, the use of technology tools in teaching and learning can develop many 21st Century skills for students (Ain et al.,2018). The features from a variety of technology tools can be used to promote students-centred learning as they are more comfortable giving feedback with the help of technology (Clark et al.,2013). This feature is supported by the research by Raja and Nagasubramani (2018) stated that the use of technology tools in education can give a positive impact as teachers can make use of various tools to help students for better understanding.

According to Zhao et al. (2019), integration amongst technology tools can enhance communication between teachers and students. Active participation occurs when teachers and students used multiple technology tools as a medium to interact with each other. Research by Musca et al. (2016) stated that the integration of technology tools in online learning not only enhances communication amongst students but also amongst peers which can help them to achieve better performance in group activities. A combination of multimedia tools can help students to remember information transfer during teaching and learning (Farah et al.,2019). Ideas can emerge easily with the help of images, sounds, actions, and animation during learning. In addition, the combination of interactive mind mapping tools with other technology tools can increase student ideas, motivation, and achievement in certain topics (Chiou et al.,2013).

3. Methodology

In this study, a pre-experimental research design with one group pre-test and post-test (Campbell and Stanley 1963) was chosen. Thirty students from a Year 4 class were chosen as samples for this research. These students will take a pre-test, then receive treatment and finally takes a post-test to see the result.

3.1 Integration of Technological Tools in Collaborative Learning

While online teaching and learning were conducted, the researcher used a few technological tools such as video, and suitable computer software for creating learning lessons based on different phases. The details about the integration of technological tools in promoting collaborative learning during teaching and learning lessons can be seen in Table 1.

Table 1. *Teaching and learning process using collaborative approach*

Phase	Teaching and Learning Activity	Tools
Phase One (Create and support an inclusive, caring, safe learning community)	- Students were asked to watch a YouTube video posted in google classroom about the Solar System in general view	YouTube, Google Classroom
Phase Two (Integrate social and emotional learning into academic instruction)	**Gathering Information (Group activity)** - Students were divided into six groups and were asked to find out planets in Solar System and their characteristics.	Google Classroom, Google Meet, YouTube
	- Students used any online resources to find out information. - Teachers monitor and evaluate their collaboration in groups while building their google jam board.	
Phase Three (Lessons must build on and support students' intrinsic motivation)	- In groups, students will share their information to build a strong fact for each planet and transfer it to the google jam board. - Teacher monitor students' discussion on Google Meet	Google Meet, Google Jam Board,
Phase Four (Learning situations should focus on students' thinking and action)	**Sharing information** - Each group conduct a presentation using Google Meet and explain their findings about planets in Solar System. - Students answered some online questions using Google Forms based on the topic learned.	Google Meet, Google Jam Board, Google Form

3.2 Solar System Test

The questions were based on the topic of Solar Systems. This test consisted of 15 multiple-choice questions. The duration of the test was 40 minutes. Table 2 shows the distribution of questions according to the subtopic.

Table 2. *Question distribution according to subtopic of solar system*

Subtopic	Distribution Question	Total Question	Total Marks
Arrangement of planets	Question 3, 5,	2	2
Characteristic of planets	Question 2, 6, 7, 11, 12, 13, 14,15	8	8
Orbit and temperature of planets	Question 1, 4, 8, 9, 10,	5	5
	Total	15	15

The reliability of the test was also conducted in this study. Ten students were asked to answer the question by using the test-retest method. Question shuffling was applied during this procedure to avoid the risk of copying the answer. Other than that, shuffling the multiple answers was one of the steps in this reliability

procedure. After the data was analysed, the coefficient alpha was at 0.852 which was near 1.0. Therefore, it can be concluded that the instrument was reliable and can be used in pre-test and post-test.

4. Data Analysis and Results

This study employed a quantitative research design. All the data collected were analysed based on descriptive analysis and inferential statistics by using SPSS software. Table 3 shows the scored data for every student in pre-test and post-solar system tests.

Table 3. *Statistic analysis of pre-test and post-test*

Student	Pre-Score	Post Score	Difference	Student	Pre-Score	Post Score	Difference
S1	12	15	+3	S16	13	15	+2
S2	12	13	+1	S17	12	14	+2
S3	8	9	+1	S18	14	14	0
S4	10	10	0	S19	4	7	+3
S5	11	12	+1	S20	11	13	+2
S6	10	14	+4	S21	11	12	+1
S7	10	14	+4	S22	7	11	+4
S8	12	13	+1	S23	5	9	+4
S9	11	12	+1	S24	15	14	-1
S10	10	15	+5	S25	9	14	+5
S11	10	12	+2	S 26	13	13	0
S12	10	12	+2	S 27	15	15	0
S13	13	13	0	S28	7	9	+2
S14	11	12	+1	S29	8	12	+4
S15	9	11	+2	S30	10	11	+1
	Mean Pre-Score		**10.43**		**Mean-Post Score**		**12.33**

S= Student n=30

Based on the result analysis of the pre-test in Table 3 above, the lowest mark was obtained by student 19 which was 4 marks out of 15. The highest mark was achieved by students 24 and students 27 with 15 marks out of 15. In the post-test, the lowest marks were obtained by student 19 with 7 marks out of 15. The highest marks for post-test were achieved by student 1, student 10, student 16 and student 27 with 15 marks out of 15.

The marks difference between pre-test and post-test can be seen in Table 3 above. The differences value was obtained by finding the differences between post-test and pre-test marks. The differences value was important to know if the respondent achievement increased or decreased after the intervention was made. Based on the table above, 24 respondents showed an increase in their achievement in the pre-test and post-test after the intervention. The highest achievement was achieved by student 10 and student 25 increasing by 5 marks. However, there was a respondent which was student 24 who decreased in achievement by 1 mark.

Overall, the achievement from pre-test and post-test could be clearly seen through comparison between the pre-test and post-test mean values. The mean value had increased by 1.9 between the pre- test and post-test. The analysis data showed that online collaboration by using Google classroom with the integration of technology tools improved the students' achievement. Normality tests were conducted for pre-test and post-test before further analysis to see if the data was normal or not normal. Based on the normality test obtained, the sig value for Shapiro Wilk was 0.034. The data was not normal as the sig value was also less than 0.05. Based on the normality test, the Wilcoxon Signed Rank test was chosen as a non-

parametric test to analyse the data. The statistical result run by the Wilcoxon Signed Ranked Test is shown in the table below. Wilcoxon Signed Ranked Test was used for the pre-test and post-solar system test to determine if there was a significantly different between pre-test marks and post-test marks after the intervention was implemented. Two hypotheses were built to determine the result.

H_0: There is no significant difference between the mean of pre–Solar System test and the mean of the post-Solar System test after the intervention was implemented.
H_a: There is a significant difference between the mean of pre–Solar System test and the mean of the post-Solar System test after the intervention was implemented.

Based on *Wilcoxon Signed Ranked Test*, the sig (2-tailed) value was 0.00. This value was less than alpha value ($p < 0.05$). Hypotheses null (H_0) was rejected. There was a significant difference between the mean of the pre–Solar System test and the post-Solar System test when the intervention was implemented in the teaching and learning process. It can conclude that the intervention gives a positive effect on student achievement.

5. Discussions

The effect of an online collaborative learning environment with the integration of technology tools approach towards student achievement can be seen through comparison between pre-test and post-test. Overall, based on the test conducted, the mean value obtained by students in the post-test increased from 10.43 to 12.33, which increased by 1.9. The results showed that the application of online collaborative learning with the integration of technology tools approach in teaching and learning could enhance student achievement in Solar System topic.

Furthermore, the result showed that there was a significant difference in score mean from pre- test and post-test, which was a value of $p = 0.000 < 0.05$. Based on this result, it was proven that online collaborative learning with the integration of technology tools could enhance student achievement in their learning process. This showed that the use of various technology tools and a collaborative learning approach helped to increase student achievement.

The results from this study were parallel with previous research which proved the benefit of using technology tools in the teaching and learning process (Iqbal & Khan,2015). This is because technology tools had potential value to create effective and high-quality learning activities (Nofaizah & Salmiza, 2019). Technology tools in the teaching and learning processes can give meaningful learning experiences to the students, and thus create various learning environments (Izwan et al, 2018). Other than that, Didem (2017) stated a few advantages of using technology tools in the teaching and learning process which helped to improve students' understanding and enhance teaching-learning quality and helped to motivate students to learn more about a certain topic. Other research by Ahmed & Shimaa (2015) also found that the use of technology tools in teaching and learning, such as educational videos, and e-books gave a positive effect on the academic achievement.

Integration of technology tools in the teaching and learning process has the potential to support and enhance the quality of teaching and learning (Izwan et al., 2018). For example, research by Rajendra (2017) which studied the connection between the integration of technology tools towards student achievement found out that there was a correlation relationship between the integration of technology tools in teaching and learning and student achievement. Research by Wael (2016) that used YouTube videos in the teaching and learning lessons found that the use of YouTube application can create more effective and efficient learning environments. These findings were also supported by another research by Raja and Nagasubramani (2018) which said that the integration of technology tools can attract students' interest and develop creative thinking.

Furthermore, another factor contributing to the increase in student achievement in this research was influenced the online collaborative learning approach that was implemented in the learning process. Fransisco and Maria (2016) said that it is important to ensure the effectiveness of using appropriate technology tools with suitable learning pedagogy to use in teaching and learning activities. Teachers must

know about learning approaches and skills in using technology tools as this knowledge will help teachers in creating effective online learning environments for students (Triayudi & Iskandar, 2019). Integration of technology tools in the teaching and learning process without proper planning will cause the learning objectives not to be achieved. This is also agreed by Jihan Rabah (2015) that teachers with knowledge of technology tools skills will have additional value as it helps to make use of the technology easier in the teaching and learning process.

Based on the importance of choosing a suitable learning approach, this research used an online collaborative learning approach that integrates with technology tools and research findings showed a positive impact on student achievement. The online collaborative approach used in this research was based on Online Collaborative Approach by Peter Brunn (2014) consisted of four phases which were creating and supporting an inclusive, caring, safe learning community, integrating social and emotional learning into academic instruction, and lessons must build on and support students' intrinsic motivation and learning situations should focus on students' thinking and action. Few studies supported the findings of this research about the effectiveness of the online collaborative learning approach in teaching and learning. Based on a study by Alex and Yuan (2017) which also researched the online collaborative approach showed that students gained high scores on their tests than the control group. Other than that, a study by Ronny and Timothy (2019) claimed that teachers view that implementing an online collaborative learning approach in secondary school give a positive impact on science subjects. The implementation of an online collaborative learning approach in the learning process can motivate students to participate actively in online activities which can help in improving their achievement.

In conclusion, the teaching and learning process using online collaborative learning approach integration with technology tools was proven one effective way to increase student achievement in education. This research finding is parallel with other previous studies as discussed above. An online collaborative approach and integration with technology tools can create a conducive, active, and interactive online learning environment. The use of technology tools with the appropriate learning approach, interesting and effective teaching and learning processes can be achieved to support education in Malaysia.

6. Conclusion

In conclusion, based on the research findings, it was found that almost all students showed positive results in their achievement. Therefore, it is hoped that this type of learning approach can be implemented in the education field to promote active learning. The young generation nowadays specifically the Alpha generation are exposed to various technology tools in their daily life. Therefore, it is believed that the integration of technology tools in an online collaborative learning approach was proven effective in enhancing student achievement, especially in science subjects if a suitable learning approach is applied.

Other than that, this research can give exposure to the teachers about the benefits of using technology tools in online learning. The use of technology tools can help teachers build and expand their idea and creativity to create an interesting learning environment (Kinshuk et al., 2016). Teachers must have technology tools skill as this is important to strengthen the use of technology in the education field. When teachers mastered some elements of technology tools in their classroom, it will attract students' attention as information is delivered variously, and thus increasing students' understanding of a certain topic (Ming Hung et al., 2017). Technology tools in teaching and learning also help teachers to monitor, control the class and train students with good value and develop students' presentation skills (Asri & Santiana, 2017).

Acknowledgement

This work was supported/funded by the Universiti Teknologi Malaysia under Quick Win Research Grant (R.J130000.7753.4J560).

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