

International Journal of Learning, Teaching and Educational Research
Vol. 19, No. 7, pp. 204-224, July 2020
<https://doi.org/10.26803/ijlter.19.7.12>

Enhancing Higher-Order Thinking Skills among Home Science Students: The Effect of Cooperative Learning Student Teams-Achievement Divisions (STAD) Module

Misra Takko

Sekolah Menengah Kebangsaan Alam Megah 2, Shah Alam Selangor, Malaysia
<https://orcid.org/0000-0002-4459-4002>

Rahimah Jamaluddin

Universiti Putra Malaysia, Serdang, Selangor, Malaysia
<https://orcid.org/0000-0002-0815-8860>

Suhaida Abdul Kadir

Universiti Putra Malaysia, Serdang, Selangor, Malaysia
<https://orcid.org/0000-0002-2761-6265>

Normala Ismail

Universiti Putra Malaysia, Serdang, Selangor, Malaysia
<https://orcid.org/0000-0002-8776-0840>

Arnida Abdullah

Universiti Putra Malaysia, Serdang, Selangor, Malaysia
<https://orcid.org/0000-0001-6593-7310>

Arasinah Khamis

Sultan Idris Education University, Tanjung Malim, Perak, Malaysia
<https://orcid.org/0000-0002-3233-4027>

Abstract. This study aims to investigate the effectiveness of the cooperative learning module using Student Teams-Achievement Divisions (STAD) techniques in enhancing students' HOTS achievement in the topic of the digestive system and food absorption. A quasi-experimental design was used in this study to gauge the effectiveness of the module. Purposive sampling technique was used to choose the respondents. The study involved 182 students who represented the experimental group and the conventional group. Students were given an intervention by using Home Science STAD Module for five weeks. Descriptive statistics and paired sample t-test were used to determine the effectiveness of the Home Science STAD module on students' HOTS achievement. The findings show

students' understanding increased for the digestive system and food absorption topics. There was a significant difference in students' HOTS achievement between the experimental learning and conventional learning group. The finding shows the students were actively engaged in teaching and learning. Post-test result shows that the students were able to answer the HOTS question correctly and they can deliver clear explanations and justifications compared to the answers in the pre-test. Findings from this study revealed that the Home Science STAD Module was appropriate to serve as a guideline for teachers who apply and integrate HOTS in the teaching process. Further studies can apply cooperative techniques in other educational contexts in promoting HOTS among students.

Keywords: Higher-Order Thinking Skills; STAD; Cooperative Learning; Home Science Education; Quasi-experimental

1. Introduction

Higher-order thinking skills (HOTS) is one of the agendas emphasized in the Malaysian education system. This is clearly stated in the Malaysian Education Development Plan 2013–2025 (KPM, 2013) which emphasizes higher-order thinking skills (HOTS) through six student aspirations. In essence, the Ministry of Education Malaysia intends to make students critical thinkers to enable them to compete globally. HOTS should be an important aspect of the teaching and learning process especially with regards to TVET in order to prepare them for future employees and problem solvers (Chinedu & Kamin, 2015). The best strategies to prepare future employees and problem solvers, is to teach students how to think instead of what to think (Chinedu, Libunao, Kamen & Saud, 2014). However, some teachers failed to apply effective HOTS teaching strategy as stated in the policy (Ministry of Education Malaysia, 2013). Chun and Abdullah (2019) in their research described the policy on HOTS cannot be fully translated into practice due to time constraints, high syllabus content, student ability, and factors of teacher's attitudes towards HOTS teaching which in turn affected teachers' perceptions and how teachers conduct their daily lessons. It remains the focus of researchers to look at the gap between education policy and classroom practice on HOTS teaching in the classroom.

In generating the HOTS among school students, active participation involving student-centered learning is seen to be significant. Constructivist learning as one of the most preferred pedagogical practices by Malaysian teachers in promoting HOTS. Teachers are keen on using inquiry teaching, problem-based learning, brainstorming and thinking map in the class (Chun & Abdullah, 2019). On the other hand, Jacobson, Davis, and Licklider (1998) stated that cooperative learning can be applied in various fields of learning, especially in technical studies. Cooperative learning is a learning method that involves four to five members in each group and emphasizes the mastery of skills, concepts, and information (Johnson & Johnson, 1994). This learning method also promotes collaboration and social cognitive skills enhancement (Virgana, 2019; Gull & Shehzah, 2015). Further, cooperative learning methods encourage students to communicate with each other, which can indirectly overcome their shyness and lack of confidence in

discussing with peers while engaging in problem-solving or group discussions. The cooperative learning methodology also contributes to other skills, such as social skills, leadership, listening, thinking, and others (Nor Hasliza, 2012).

Secondary School Standard Curriculum, Home Science education is one of the elective subjects under the stream of Science, Technology, Engineering, and Mathematics (STEM) for form 4 and forms 5 students. The main purpose of this subject is to provide students with knowledge as well as preparing them with various skills such as critical thinking, creative and innovative thinking skills, and a positive attitude among the students. To accomplish the main goals of the National Philosophy of Education, six Secondary School Standard Curriculum frameworks have been integrated, which blend knowledge, skills, and values with 21st-century learning skills.

In Malaysia classrooms, teacher-centered learning or lower-order thinking skills (LOTS) is taking place and being practiced in teaching and learning process that inhibit the development of HOTS (Arlina & Melor; 2014; Bavani et al 2016; DeWitt et al 2016; Aziz & Andin, 2018). In most situations, teachers only serve as informants and students act as recipients of information (Vebrianto & Osman, 2012). Conventional learning does not encourage two-way interaction that helps student thinking process. This method only helps students to only memorize the concept of learning and yet the aspect of thinking is left out (Vebrianto & Osman, 2012). This scenario has caused difficulties to students in applying thinking skills because they are not exposed to problems solving activities, which may generate their creative, critical, and innovative thinking. This ultimately results in students' thinking skills will remain at a low level (Wan & Shamilati, 2018; Khairon, Hanita, Fauziah & Azian, 2017; Aziz & Andin, 2018). New examination format of assessment structure required students to master the learning content to enable them to answer HOTS questions. In the previous examination format, the focus was on objective questions that required students to memorize the content to achieve excellent results.

According to the statistics of the Ministry of Education, students choose the stream of Science, Technology, Engineering and Mathematics (STEM) in schools which contribute to 44 percent in 2018 compared to 48 percent in 2012, a decrease in four percent. This four percent drop is equivalent to 6,000 students drop (Yeo, 2019). This figure also includes students who took Home Science Education as an elective subject since Home Science Education was one of the subjects under STEM stream. Based on the Malaysian Certificate of Education results, it was reported that students did not achieve satisfactory results in HOTS, with the average grade of less than 3.00 for the Home Science subject. Due to this scenario, a cooperative learning module by using STAD techniques has been developed to overcome this problem, especially to help Home Science students master difficult topics such as the digestive system and food absorption.

Although numerous studies have investigated cooperative learning approaches in enhancing student achievement (Okwelle & Owo, 2018; Gull & Shehzah, 2015; Ling Ghazali & Raman, 2016; Isiaka & Yusuf, 2015; Anwar, Tatlah & Butt, 2018), a

few studies that examine students' achievement in HOTS essay questions in Malaysia especially in the context of the technical subject such as Home Science Education. Therefore, there is a need for more knowledge about the effectiveness of cooperative learning in enhancing not only student academic achievement but also enhancing students HOTS as well as other soft skills such as communication, problem-solving, collaboration, and motivation.

1.1 Objective, Research Question and Hypotheses

The main objective of this study is to investigate the effectiveness of the cooperative learning module using Student Teams-Achievement Divisions (STAD) techniques in enhancing students' HOTS achievement in the topic of the digestive system and food absorption. The study further explored the differences in HOTS achievement among Home Science students before (pre-test) and after (post-test) they learned using the module. The research question and hypotheses are as follows:

Research Question:

- i. Is there an impact on students' HOTS achievement in learning digestive system and food absorption topic using Student Teams-Achievement Divisions (STAD) techniques?
- ii. What are the minimum and maximum marks of pre-test and post-test for the cooperative learning group and conventional learning group?
- iii. Is there any improvement of students HOTS answer between pre-test and post-test?

Research hypotheses:

H₀₁: There is no difference in students' HOTS achievement HOTS in the pre-test between the cooperative learning group and conventional group

H₀₂: There is no difference in students' HOTS achievement in the post-test between the cooperative learning group and conventional learning group

H₀₃: There is no difference in students' HOTS achievement in the pre-test and post-test for conventional learning group.

H₀₄: There is no difference in students' HOTS achievement in the pre-test and post-test for cooperative learning group.

2. Theoretical and Conceptual Framework Used in the Module Development

Three cognitive theories namely constructivism, cooperative learning, and Bloom's Taxonomy are used in this study to illustrate the relationship between these theories in developing the Home Science STAD module. These theories provide a better understanding in testing students' ability to answer HOTS questions as shown in Figure 1.

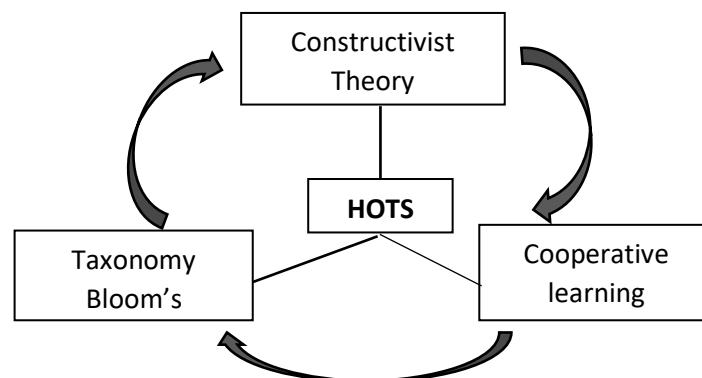


Figure 1: Theoretical Framework

2.1 Constructivist Theory

According to the theory of constructivism (Vygotsky, 1978), knowledge is actively built by thinking individuals, while passive individuals do not accept any knowledge conveyed by their teacher. Students will adapt any new information to their existing knowledge to create new knowledge in their minds. When they come across objects that are meaningless to them, they will interpret what they see and customize their information so that they can better interpret this information (Yadav, 2016; Bhutto & Chhapra, 2013).

Constructivism implies that teaching and learning will be student-centered. The teacher serves as a facilitator that helps students build knowledge and solve problems. The teacher will also identify students' existing knowledge and tailor his/her teaching method to the basic nature of the knowledge. Also, teachers serve as instructional designers that provide opportunities for students to build new knowledge. Learning based on the theory of constructivism is a process by which students develop new ideas or concepts based on their current knowledge. Students will choose and interpret information, formulate hypotheses, and make informed decisions as they provide meaning and experience formation (Olusegun, 2015; Yadav, 2016). Instead of providing students with answer, teachers must challenge them by encouraging effective critical thinking (Chinedu, Libunao, Kamen & Saud, 2014). This is coherent with the study which is emphasises HOTS in Home Science Education.

2.2 Cooperative Learning

Cooperative learning refers to instructional use of small groups so that students work together to maximize their own and each other's learning (Johnson & Johnson, 1999). It is a principles and techniques for helping students work together more effectively (Jacobs, Power & Loh, 2002), teaches them how to interact and socialize, exchange ideas, share information, and emphasizes the mastery of skills, concepts, and information in which students are classified into specific groups (Nurulhuda, 2014; Slavin, 1995). They are various techniques under cooperative learning. Some cooperative learning techniques utilize student pairing such as Think-Pair-Share, Think-Pair-Write, Three-step Interview, Say and Switch. While others utilize small groups of four or five students such as Round Robin, Reciprocal Teaching, Jigsaw II, Circle the Sage, The Williams and

including STAD or Student-Teams-Achievement Division (Kagan, 1994, Slavin 1995). According to Johnson and Johnson (1994), students who learn to cooperate in a group can enhance their performance. After all, they can learn better and become responsible students because they have group goals that need to be achieved together.

Cooperative learning is an effective learning strategy because, through this method, students with different levels of ability, skills, and thinking learn together in a group. To ensure a successful cooperative learning process, each student is responsible for sharing existing knowledge and skills to help other team members (Okwelle & Owo, 2018). Furthermore, each member of the group should be highly committed to the task assigned. Cooperative learning will encourage students to interact actively and positively in a group (Mark-Mensah & Sam, 2018; Anwar, Tatlah & Butt, 2018). Engaging in small group activities can develop high-level thinking skills and enhance individuals' ability to apply knowledge (Virgana, 2019; Brame & Biel, 2015; Rahayu, Syafril, Wati & Yuberti, 2017) as well as increasing student motivation during group discussions and achievement (Gull & Shehzah, 2015; Isiaka & Yusuf, 2015; Ling, Ghazali & Raman, 2016).

In general, cooperative learning is collaborative learning or cooperation involving small groups with various levels of capability and achievement as well as a different gender, race, and religion (Johnson & Johnson, 1994). To achieve common goals within a group, the most important attribute is a student's success in helping others achieve their goals and objectives in their learning. In this study, the researchers have chosen the Student Teams Achievement Division (STAD) technique because it is more effective than others. One of the advantages of STAD is each group consists of heterogeneous students. After students having their group activities, each member will participate in a quiz or individually calculated test. Then, the scores earned by each group member will be added to the group score. Finally, the best group will receive a prize as a token of recognition to the group. Using this technique, students can easily master the topic through discussion and collaboration of small groups of 4 to 5 members. Indirectly this technique can improve Home Science students in mastering their subject content. So, in this module, cooperative learning with the STAD technique is used to achieve the teaching and learning objectives.

2.3 Taxonomy Bloom's and Higher-Order Thinking Skills (HOTS)

The rapid development in the 21st century, education is a major concern as it contributes to fostering students' readiness to face global challenges and prepare them to enter the workforce (Larson & Miller, 2012). This requires students to master the 21st century skills, especially HOTS which need to apply by the educators into teaching-learning activities (Hashim, Ali & Sahmsudin, 2018). 21st century skills were defined as skills that progressively ask for creativity, perseverance, and problem solving combined with performance. According to Collins (2014) the awareness of educational stakeholders on the importance of teaching HOTS is very prominent to ensure learning success.

Using HOTS in the classroom also requires more than giving students HOTS questions, rather students must be taught how to make thinking visible and this can be done with teacher guidance (Siti, 2016). According to the Malaysian Examinations Board (2013), higher-order thinking skills (HOTS) is the ability to apply knowledge, skills, and value in forming reasoning and reflection of problems, decision making, innovation, and creation of something. According to Gillies (2014), HOTS is defined as a widespread challenge and use of the mind set when one must interpret, analyse, or manipulate information to answer a question. The foundation of the cognitive process is to generate and organize information, analyse, synthesize, be creative, and perform evaluations.

Thinking skills are one of the six key characteristics that students need to have to ensure that they reach their full potential and can compete globally (Ministry of Education Malaysia, 2013). According to Anderson and Krathwohl (2001), thinking skills are the most basic skills that can be developed in the classroom and are key to high achievements for all students. As such, the HOTS has been implemented through five elements, namely pedagogical curriculum, curriculum assessment, private community support, bodybuilding, and resources.

Realizing the urgency of the 21st century skills, HOTS approach is fundamental to the framework of the formation of a global education system, and it is no exception to Malaysia that has adopted the Bloom and Anderson taxonomy through Malaysian Education Development Plan 2013–2025 (Ministry of Education Malaysia, 2013). The Ministry of Education has emphasized on HOTS in the school system by introducing the I-THINK program in 2011, starting with 10 pilot schools, followed by all the schools in Malaysia in 2014 as a preparatory step to implement HOTS in Malaysia's education curriculum (Ministry of Education Malaysia, 2013).

Developing HOTS in classroom requires teachers not only need to have subject matter knowledge, but they also have to know what HOTS contains of and how it can be included into the curriculum (Daud, 2017). Teachers need to provide the students with HOTS which Mishra & Kotecha (2016) claim the Bloom's revised taxonomy as reference point to HOTS.

Based on constructivism theory, cooperative learning and Taxonomy Bloom's, the researcher has constructed the conceptual framework of the study as in figure 2. The framework of this study includes two independent variables namely cooperative learning and conventional learning. While the dependent variable was the higher order thinking skills (HOTS).

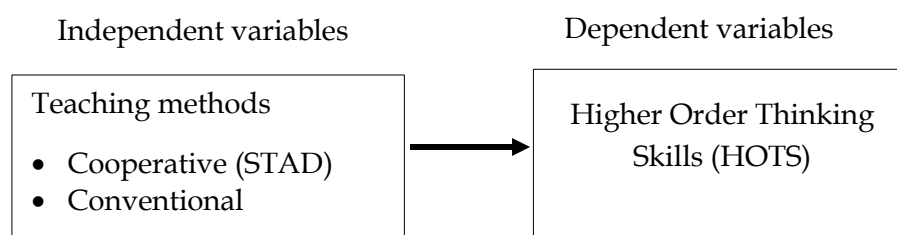


Figure 2: Conceptual Framework

2.4 Home Science STAD Module

The Home Science STAD module was developed as a result of data collection through document analysis involving content, the Home Science Curriculum and Assessment Standard Document (Bahagian Pembangunan Kurikulum, 2015) and the previous year's Malaysia Certificate of Education questions. The construction of this module also considered the feedback obtained in a semi-structured interview with Home Science expert teachers. Based on the interview, researcher was informed that digestive system and food absorption topic is one of the most challenging topics for Home Science courses. Students do not understand the topic because it involves scientific processes as well as enzymes that need to be memorized. Analysis of past exam questions also showed the existence of HOTS questions related to this topic. According to that findings, researchers chose to build the module by focusing on the topic digestive system and food absorption. This Home Science STAD module was developed into two editions, namely teacher edition and student edition.

The teacher edition of the Home Science STAD module was developed as a guide to enable teachers to implement cooperative learning more effectively according to the prescribed procedures. The teacher edition module includes the introduction to cooperative learning, daily lesson plans, examples of induction sets that teachers can use, descriptions of the implementation of cooperative learning activities, handout notes for students including six different types of exercises by topic, quizzes and short essay questions, and an answer scheme. Meanwhile, the student edition module was designed as a learning material consisting of introductory notes to cooperative learning, six different types of exercises by topic and by group, quizzes and short essay questions, and additional notes for students as a reference in addition to textbooks.

The module includes four key components involving activities for teachers and students in teaching and learning, teaching content, explanation on how to divide students into groups, and how to conduct group learning, quizzes, and group recognition. The teaching content contains a description of the teaching material to be delivered by the teacher based on the topic. Then, to facilitate student understanding, group activities are conducted to enable students to share ideas, opinions, and information with their peers. After completing a certain topic, quizzes will be conducted to measure students' understanding of that particular topic. As a motivation and encouragement for students to stay motivated and engaged in group learning activities, group recognition is given based on the group scores obtained.

3. Methodology

3.1 Research Design

To investigate the effectiveness of the Home Science STAD module among Home Science students, a quasi-experimental of pretest-posttest nonequivalent groups design was used. According to McMillan (2011), this design of research is among the most widely used. The design of this research involves the treatment and control groups by using pre- and post-trials. The rationale of using pretest-posttest nonequivalent groups, this design can be used to test the comparison of effects in

various situations where fully experimental techniques are not feasible (Neuman, 1991) especially in real-world situations such as in schools setting. Through this design, researchers can identify the possible effects of learning methods used on dependent variables (Ary, Jacobs, Sorensen & Razavieh, 2013) as well as this design of research is among the most widely used (Cook dan Campbell, 1979). This study involves the treatment of cooperative learning (X1) while the control groups (conventional learning) did not use any instructional module but only followed the traditional teaching (X2). To assess the level of students' existing knowledge of the digestive system and food absorption, a pre-test was conducted and represented by O_{A1} followed with post-tests which represented by O_{B2} to measure students' HOTS after finished 5 weeks teaching and learning process. The research design as shown in figure 3.

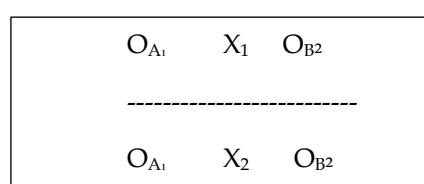


Figure 3: Research Design

3.2 Samples

Two schools in Selangor and two schools in Negeri Sembilan were involved in this study. To answer research objectives and fulfil the number of samples for experimental groups, a purposive sampling technique was used. Given by the state education department in Malaysia, the number of students in one class are about 20 to 30 students depends on the school location. Limited number of secondary schools in Malaysia offer Home Science Education courses. In order to gather at least 40 students for each experimental group, researchers decided to choose two Home Science Education classes with special category such as form four students. Number of respondents chosen in this study was 197. These two classes have made the total number of respondents for the study 197, non-responses were 15 students who absented comprising 91 samples for treatment group (cooperative learning) and 91 samples for control group (conventional learning). To overcome the bias, researchers only used 182 respondents in this study. The response rate was 92.4%.

3.2 Research Instruments and data analysis

In this study, a test questions were developed purposely to measure student's achievement in answering HOTS. A focus group interview with expert teachers in Home Science Education was done before researchers develop the module and test questions. Based on discussion with the focus group, it was reported that students have difficulty answering essay questions, especially HOTS. As a result, researchers have analysed the previous year questions of Malaysian Certificate of Education examination for Home Science subjects, and it was found that there are two or more HOTS questions related to the topic of the digestive system and food absorption. Based on that information, test questions were developed based on the Curriculum and Assessment Standard Document as well as previous year examination questions. A structure question consisted of 11 short essays were

given to the student in pre- and post-test. Students need to answer all the questions within 1 hour and thirty minutes in an examination setting.

Pre-tests were given to students before cooperative learning using the Home Science STAD module begins. This is to attain students' knowledge on the topic of digestion and food absorption. If the level of students' knowledge for both groups was about the same, then the two groups is suitable for carrying out the study (Cook & Cambell, 1979). Treatment groups were exposed to five different topics, different group activities and quizzes for every week. After students have completed five weeks' learning sessions, they answered post-test questions which examined students HOTS achievement using the Home Science STAD module. Student answers script will be evaluated and given marks based on the scoring scheme provided. Then, student's marks will be summed up and given the appropriate grade based on the upper secondary scoring grade system 2016 used by all schools in the School Examination Analysis System under the Ministry of Education Malaysia. Researchers appointed and trained selected Home Science teachers from both schools to distribute the test questions and handling the modules to respondents. To monitor the data collection process, the researchers observe these selected teachers. The examples of the question as shown in Figure 4.

1. Figure 1 shows the human digestive system.

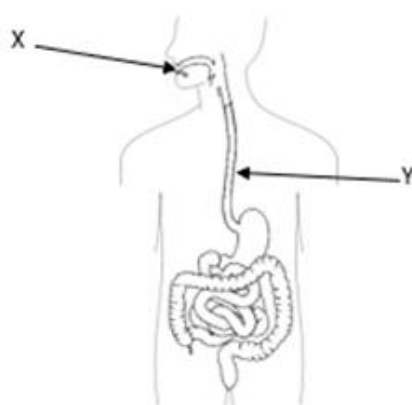


Figure 1



Figure 2: Food A



Figure 3: Food B

During recess time, Aminah ate food A and food B as shown in Figure 2 and 3.

- In your opinion, what would happen to Y in Figure 1 if the food was not processed through X? (4 marks)
- Identify the key nutrients found in foods A and B. What is the effect of these nutrients' deficiency on the human body? (4 marks)
- Aminah loves fried chicken. She would buy more than one fried chicken every day. What will happen to Aminah's health if this habit continues? (6 marks)

2. Fahmi is a 9-year olds student majoring in engineering education. He can eat chicken rice and fried noodles as his lunch. Table 1 shows the proportion and composition of nutrients contained in the food.

Table 1: Food proportion and composition

Food	For every 100gm eaten			
	% EP	Protein (gm)	Fat (gm)	Carbohydrate (gm)
Chicken Rice 150 gm	92%	70 gm	1.4 gm	20.0 gm
Fried Noodle 250 gm	97%	4.9 gm	7.6 gm	26.3 gm

- Explains the effect of consuming the above foods in excess quantity. (4 marks)
- Based on Table 1, which nutrient contributes to Fahmi's highest energy value? Elaborate. (4 marks)
- As a sports athlete, Fahmi needs the energy to stay active. Fahmi prefers drinking more energy water than mineral water. Do you think his action is correct? Give your argument. (6 marks)

Figure 4: Examples of HOTS question

3.3 Validity

To ensure that the effects of threats can be well controlled in experimental studies, researchers have considered several internal validities namely history, maturation, selection of samples, and instrumentation. To mitigate the impact of this threat, researchers have established a study period of 5 weeks. This study was conducted in a short period of time to reduce the maturation threat. To increase the internal validity, researchers decided to choose two classes at the same school for cooperative learning and conventional learning groups. Where the students in the two classes have similar age, the teachers are the same sex, and have similar teaching styles. The selection of samples was also made based on students' achievements scores in previous year examination. This is to avoid the effect on dependent variable if the selected samples were smarter or more in favour of a group.

In order to validate the test questions and the modules, the researchers submitted the documents to three experts' educators in Home Science Education field for language, face and content validity. Feedback received was used to enhance, improve and strengthen the test questions. The test questions later were administered to 30 students at one of secondary schools in Kuala Lumpur for face and content validity. The validity was ascertained to ensure that the test questions, and modules developed were suitable to use in formal data collection. The findings obtained from the study were analysed by using the SPSS version 23.0 software to determine the effectiveness of the Home Science STAD module by using descriptive statistics and paired sample t-test.

3.4 Data Collection Procedures

Figure 6 visualised the data collection procedure for treatment group of cooperative learning.

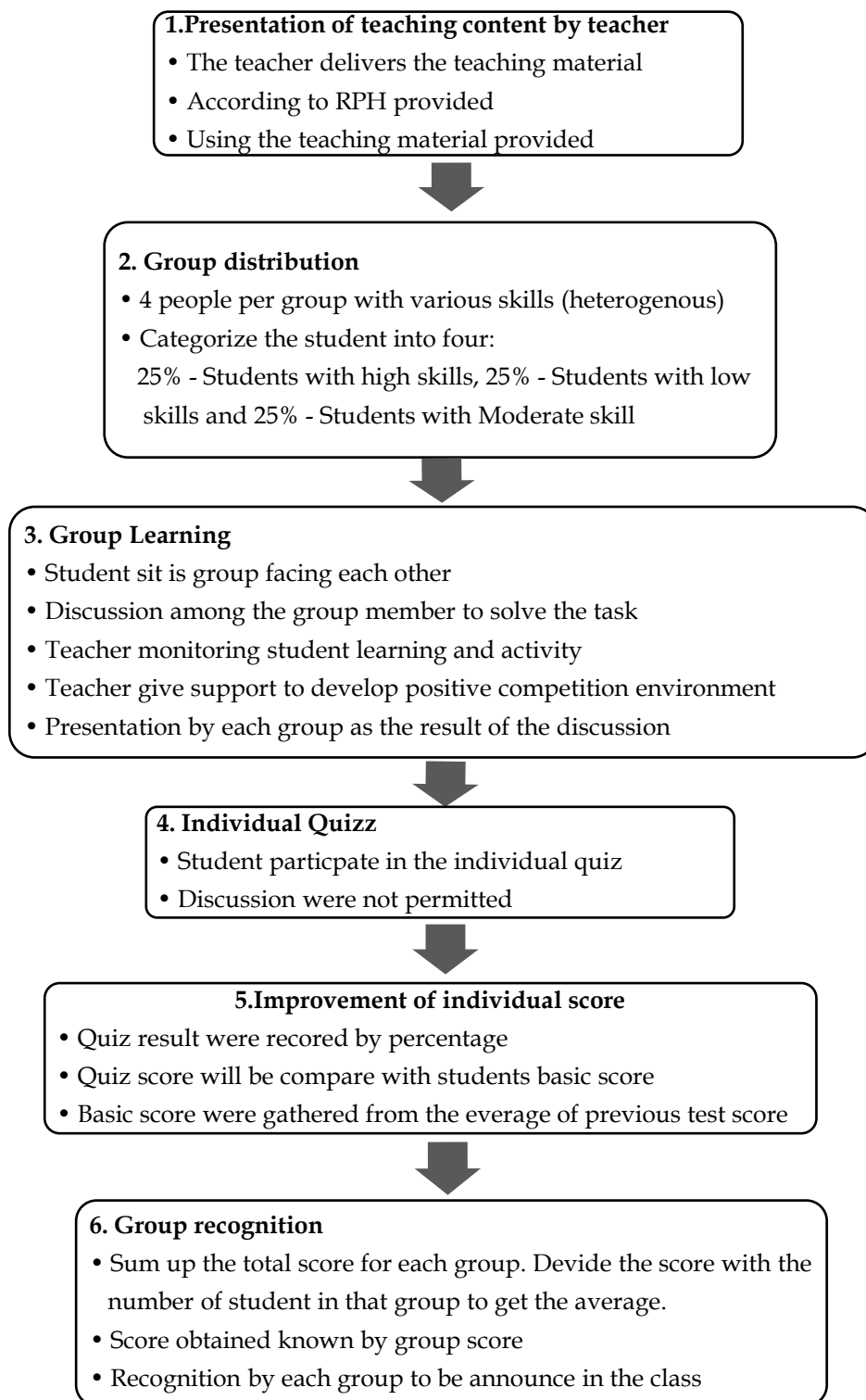


Figure 6: Procedure for treatment group (cooperative learning)

4. Findings

4.1 Students' HOTS achievement in pre-test between the cooperative learning group and conventional group

Table 1 shows the students' pre-test HOTS achievement for cooperative learning and conventional learning groups. Based on the analysis, the cooperative learning group had a mean score of 31.35 (S.D. = 11.55), while the conventional learning group had a mean score of 29.15 (S.D. = 12.67). These findings showed that there was no significant difference in the mean scores for pre-test HOTS achievement between the two groups ($t(180) = 1.223, p = .223 > .05$).

Table 1: Pre-test HOTS achievement for the cooperative learning group and conventional learning group

Group	No. of students	Mean	Standard deviation	t-value	Degree of freedom	Significant
Cooperative	91	31.35	11.55	1.223	180	.223
Conventional	91	29.15	12.67			

These findings indicated that before the learning session was conducted, students' knowledge of the digestive system and food absorption among the two groups of the respondent was the same. Therefore, both groups of respondents suited the research requirement and the purpose of this study. The results also indicated that the threats in terms of sample selection could be reduced before performing the experiments.

4.2 Students' HOTS achievement in the post-test between the cooperative learning group and conventional learning group

Table 2 shows students' achievement based on the post-test that was conducted for the cooperative learning group and conventional learning group. Based on the analysis, the cooperative learning group obtained a mean score of 54.41 (S.D = 12.04), while the conventional learning group obtained a mean score of 38.36 (S.D = 8.04). These findings indicate an increase in HOTS achievement for both groups. The findings showed that there was a significant difference in the mean scores between the two groups ($t(157) = 10.57, p = .000 < .05$), and the cooperative learning group outperformed the conventional group.

Table 2: Post-test HOTS achievement for the cooperative learning group and conventional learning group

Group	No. of students	Mean	Standard deviation	t-value	Degree of freedom	Significant
Cooperative	91	54.41	12.04	10.57	157	.000
Conventional	91	38.36	8.04			

4.3 Students' HOTS achievement in the pre-test and post-test for conventional learning group and cooperative learning group

Furthermore, paired sample t - test were conducted to test differences in students' HOTS achievement between pre- and post-test for the conventional learning group. According to Table 3, findings show that the mean score for the pre-test was 29.15 (SP = 12.67) and the mean value for the post-test was 38.36 (SP = 8.04). The findings show that the mean score of student HOTS achievement in the post-

test is higher than the mean score for the pre-test of conventional learning group students. Data analysis revealed that there was a significant difference in mean scores between the pre-test of 29.15 (SP = 12.67) and the post-test of 38.36 (SP = 8.04); $t(90) = -6.627, p = .000 < .05$.

Table 3: Pre and Post-test HOTS achievement for the conventional learning and cooperative learning group

Group	Number of students	Mean	Standard deviation	t-value	Degree of freedom	Significant
Pre-test	91	29.15	12.67	-6.627	90	.000
Post-test	91	38.36	8.04			
Pre-test	91	31.35	11.55	-12.99	90	.000
Post-test	91	54.41	12.04			

Same goes to cooperative learning group (Table 3), analysis indicated a higher mean score in post-test with 54.41 (SP = 12.04) compared to pre-test 31.35 (SP = 11.55). The results of the study showed that there was a significant difference in mean score between pre-test 31.35 (SP = 11.55) and post-test 54.41 (SP = 12.04); $t(90) = -12.99, p = .000 < .05$.

4.4 Distribution of minimum and maximum marks of pre-test and post-test for the cooperative learning group and conventional learning group

To gain a deeper understanding, the researchers has performed a cross-sectional analysis of the pre- and post-test test scores for both groups. Findings showed that the pre-test score for the cooperative learning group range from 9 marks to 57 marks. Meanwhile, the pre-test score for conventional learning groups ranges from 7 marks to 52 marks. Besides, the post-test score showed that the mark for cooperative learning group range from 24 to 80 and score for conventional learning groups range from 20 to 53 mark.

Data in Table 4 shows the minimum and maximum scores distribution of pre- and post-test scores for the cooperative learning and conventional learning group. Based on the data, the number of students who failed the pre-test for both groups (cooperative and conventional) was high, 71 (78%) for the cooperative learning, and 69 (76%) for the conventional learning group. Student HOTS achievement after the post-test indicated the number of students who pass increased for both groups. However, the highest increase was observed in the cooperative learning group with the number of students passed up to 59 students. Compared to the conventional group, only 19 students got a mark of more than 40. It can be described that the number of cooperative learning group students who failed was decreased from 71 (78%) to 12 (22%). For the conventional learning group, the number of students who got marks below 40 is still considered higher with 50 (55%).

Table 4: Distribution of minimum and maximum marks in pre-test and post-test for cooperative and conventional learning groups

Marks	Cooperative learning group		Conventional learning group	
	Pre-test	Post-test	Pre-test	Post-test
Fail (0-40)	71 (78%)	12 (13%)	69 (76%)	50 (55%)
Pass (41-100)	20 (22%)	79 (87%)	22 (24%)	41 (45%)

4.5 Analysis from student's answer script

A qualitative analysis was done to better understand students' ability to answer structure essay questions. The findings showed that the way students answer the HOTS question was improving. From the pre-test findings, the answers given by the students were limited, short, and unclear. Students were not capable to provide a good explanation with many examples or justifications. Many questions were not answered correctly and some of the questions were left unanswered. This finding can be observed for both groups. As an example, for question 2a (refer Figure 5 page 11) explains the effect of consuming the above foods in excess quantity. The answered given by the respondent are; can cause obesity because the fat content in the food is high (respondent 1), cause obesity (respondent 2) and obesity, excess fat (respondent 3).

Interestingly, findings in post-test analysis showed that students were able to answer the questions correctly. They can provide a good explanation, clear justification, and reasonable answers and the answers were written in a long sentence. Such as; the effects of taking the food on a regular basis in excess amounts will cause obesity as eating too much. In turn, it can lead to overweight and inability to perform any heavy and difficult activities (respondent 1), has a variety of diseases including obesity. We need to eat a balanced diet and follow the food pyramid to prevent obesity. It can be difficult to do activities and can cause us to become inactive (respondent 2) and the effects of food intake on a regular basis can lead to obesity, especially fat and more other disease (respondent 3).

5. Discussion

This research has shown that the effectiveness of using Home Science STAD Module enhancing students' ability to answered HOTS questions for topic the digestive system and food absorption. It was found that even though the respondents were among weak students, their achievements improved after they were exposed to cooperative learning. This finding indicates that through an appropriate learning process and teaching techniques, students were able to remember and understand the content. This is evident when the cooperative learning group of STAD recorded a better achievement compared to the conventional learning group (Hasmyati & Suwardi, 2018; Adeneye, Alfred & Samuel, 2012; Isiaka & Yusuf, 2015; Ling, Ghazali & Raman, 2016; Rahayu, Syafril, Wati & Yuberti, 2017; Yunita, Juneau & Relmasira, 2018).

The findings of this study parallel with research done by Slavin (1996) who stated that cooperative learning method can give an impact on students' achievement.

This is because having supportive and group activities such as quizzes and exercises help students to better understand and achieve their learning goals and objectives. Students who helped their peers in sharing information through group discussion can encourage themselves to get better result. For weaker students, they need to be given ongoing training and guidance to enhance their understanding and enable them to answer the HOTS questions. This finding also support the cooperative learning theory (Johnson & Johnson, 1994) who stated that students' failure to answer test questions, especially in the form of HOTS, is not because they are weak students. Sometimes students with low achievement tend to have difficulties to understand the terms used in the higher-order thinking skills questions, no matter the language use whether in Malay or English (Ahmad, Abu & Abdullah, 2017). Because language have positive relation to the high order thinking skills among the students (Ali, Mokhtar & Jamaluddin, 2017). Therefore, the students' needs guidance from their teachers to learn how to respond for HOTS questions (Chinedu, Libunao, Kamen & Saud, 2014) and teachers as educators need to be creative in seeking alternative teaching strategies and techniques to ensure the delivery method used by the teachers following the various levels of student intelligence (Yee, Ping, Yunos, Othman, Tee, Mohaffyza & Bc ,2019; Chinedu & Kamin, 2015, Azian, Fauziah, Noor & Norhanim, 2017).

These findings indicate that cooperative learning using the Home Science STAD module is very effective in improving student achievement in answering short essay questions. The findings are in line with previous studies conducted by Nurulhuda (2014), Tsay and Brady (2010), Zahara and Suzela (2011), Okwelle and Owo (2018), Gull and Shehzah (2015), Virgana (2019) who also found there were significant difference in students' achievement towards cooperative learning methods. Therefore, cooperative learning needs to be expanded and used by all Home Science Education teachers in teaching and learning to enhance students' understanding, especially in the topic of the digestive system and food absorption, as well as producing a conducive learning environment.

6. Conclusion

This study was conducted to examine the effectiveness of the cooperative learning Home Science Module using Student Teams-Achievement Divisions (STAD) techniques in enhancing students' HOTS achievement in the topic of the digestive system and food absorption. In this study, three hypothetical statements were accepted. Analysis of the post- test scores in comparison for both groups showed a significant difference between mean scores for HOTS achievement. Analysis of the students' pre-test and the post-test for both groups showed there was a significant difference in mean scores of HOTS. The number of students who pass the HOTS questions increased for both groups. However, the highest increase was observed in the cooperative learning group. Moreover, findings showed that student we able to answer the HOTS questions in a long sentence with a good explanation and justification.

The success of the teaching and learning process depends on the activities carried out by the teachers in class. The methods or strategies used by teachers in delivering knowledge to the students significantly influence student achievement

and cognitive skill enhancement (Chinedu & Kamin, 2015; Virgana, 2019; Gull & Shehzah, 2015). Therefore, teachers need to be wise in designing and selecting teaching methods and strategies that are considered appropriate with students' abilities and intelligence (Chinedu, Libunao, Kamen & Saud, 2014). The cooperative learning method using the Home Science STAD module is one of the approaches that can be used to complement the conventional learning method practiced by Home Science Education teachers. This is because cooperative learning methods provide students with the opportunity to acquire knowledge and develop other 21st-century skills such as teamwork and communication skills (Nor Hasliza, 2012). Also, this finding assures educators, especially Home Science Education teachers that student-centered learning is best applied to students with low academic achievement. This finding supports the theory of constructivism which stated that learning becomes more meaningful when students are directly involved.

7. Implication and Suggestion

The findings could have important implications for ensuring the successful and effective development of HOTS among Home Science teachers and students. Specifically, findings of the current study are significant to Teacher Training Institutes, universities that offer teacher training programs, pre-service and in-service teachers, researchers, and other related stakeholders in the field of education. The evidence of this study could enhance our understanding on the effectiveness of cooperative learning in promoting student's knowledge and ability to answer HOTS questions. Hence, school authorities must consider to use cooperative learning in the areas of Technical and Vocational Education (TVET). Given that the nature of TVET students is similar to Home Science Education students, this will help to improve student's achievement. Findings of this cooperative learning study should be disseminated to all schools in Malaysia to encourage other teacher to consider the instructional methods (Ling, Ghazali & Raman, 2016). All educational stakeholders, especially the government as the policy makers should take the responsibilities to enhance and integrate HOTS in the process of teaching and learning. The Ministry of Education needs to provide continuous training and supervision to the teachers as well as teaching materials (Mei, Joko, Sri & Hening, 2019) in order to deal with the challenges of HOTS development. It also serves as a basis for the design of more effective and holistic approaches of teaching and learning strategies for HOTS, so that the goal of developing students' critical thinkers as stated in the education policy can be achieved.

This study clearly shows that it is necessary to conduct a more extensive research on cooperative learning in helping weak students specially to master their subject content as well as equipped them with 21st century skills. This is important for educators to prepare the students as future employees and problem solvers (Chinedu & Kamin, 2015) with regards to achieve Malaysian aspirations as mention in Malaysia Education Development Plan 2013–2025.

8. The strengths and weaknesses of Home Science STAD Module

The main strength of Home Science STAD module (teacher edition) is, it helps facilitate and streamline the teaching and learning process. Because the module has been equipped with teaching materials such as group division, activities, quizzes, evaluation forms and recognition. The presence of the module is very helpful for teachers. As for the student, it can be observed that student edition module can attract them to learn with the presence of pictures and colourful pages. Learning by using Home Science STAD module able to stimulate students' interest to participate in group activities actively. Since the group was heterogeneous, nobody was left behind. Members of the group helping each other to gain high individual marks because it contributes to the group marks for them to get recognition. One of the disadvantage of module is that teachers need to prepare in advance the teaching materials before they can conduct a cooperative learning class. Otherwise, the teaching and learning process will be disrupted.

9. Limitations

Due to time constraints for this project, only two classes in two schools were used in the study. The findings from the study can be generate to similar school that offer Home Science Education courses. More schools need to be included in the study. Further, experimental study procedure can be improved if the students be punctual during the data collection process.

10. Acknowledgments

This project is sponsored by Universiti Putra Malaysia grants for the GP-IPS/2017/9564800 project.

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