本報告は千葉大学教育学部吉田雅巳研究室オンラインゼミ（2020 年 8 月 18 日）で発表された，課題研究報告である。
This report was presented at the online seminar of Yoshida Laboratory, The Faculty of Education, Chiba University, 18 August 2020, as an assignment of investigation.

Comparison of Various Jigsaw Strategies

様々なジグソー法についての比較

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ABSTRACT

This study reviews the development processes of Jigsaw strategies, and aims to investigate the variety of Jigsaw methods and compare their characteristics. Previous studies confirmed that the Jigsaw technique is an effective cooperative learning technique that promotes positive attitudes and interest in students for developing inter-personal skills. Meanwhile, it has significantly increased students' academic achievements compared to traditional methods. Analyzed papers related to the Jigsaw method were collected, and then the similarities and differences in the development process were summarized, while elucidating the significance of the improvements. From this process, it is found that the Jigsaw technique has some limitations. Therefore, this review will put forward some suggestions about how to improve this technique.

概要

この研究では、これまで提案されたジグソー法の発展プロセスを調査し、その特性を比較することを目的としている。 先行研究では、ジグソー法が人間関係の技能を伸長するための学生の前向きな姿勢と興味を促進することを狙った協同学習の一類型であるとされる。 同時に、従来の方法と比較して学生の学業成績を大幅に増加させたことが報告されている。 本調査では，ジグソー法に関連する分析論文を収集し、発展の中での改善点について注目し、発展プロセスの類似点と相違点についてまとめた。 その結果、ジグソー法にはいくつかの制限があることがわかった。 そして，この手法を改善するための提案をおこなった。

Key words: Jigsaw method; investigation; limitations; significance

キーワード：意義；ジグソー法；制限；調査

1. Introduction

As an individual, each student’s abilities, learning styles, thinking styles, motivation levels and interests differ from each other. The same teaching technology can not satisfy everyone's needs. The modern educational system and science education advocate the use of student-centered instructional methods and techniques, which can help the students to master their knowledge, and thus will assist them to apply this knowledge to their daily lives. To adapt to the changes in the world, educational methods should also change at the

same time.

According to the MEXT (The Ministry of Education, Culture, Sports, Science, and Technology) website, an Active Learning & Curriculum Management Summit was held in 2018 and 2019. The themes of the 2019 Summit included the following.

1）Promote improvement of learning and teaching methods from the perspective of active learning, which is proactive, interactive, and based on the essential learning of subjects.

2） Research on curriculum management to foster the qualities and abilities required in the coming era.

3）By setting up a place to publicize the research results of the active learning promotion project and curriculum management research, and by giving a lecture that organically links them, the summit will be more effective based on both research results, and encourages the realization of educational practice.

Active learning, in the general literature, does not refer to a specifically defined pedagogy but was popularized in the literature on higher education as a way to describe more active, student-centered forms of learning. Popularized in the early 1990s (Bonwell, 1991), cooperative learning is known as one of the approaches to active learning. Jigsaw is one of the cooperative learning techniques that has been widely used for years.

1.1 Three aims of this review:

1)

To compare previously proposed variations of Jigsaw strategies in terms of the procedure for the class process.

2)

To compare the evolution of the student communication component in the Jigsaw method at each step.

3)

To understand the differences of intended targets of activities, especially the expected competencies of students developed through communication.

2. Background of Jigsaw Strategies

In the 1970s, there was observable competitiveness in every area between society and classroom. Competitiveness is not inborn, but it seems to be so because it is learnt at a very early stage. Undoubtedly, it is communicated and fostered by the family and the media. However, one of the major places where competitiveness is taught, indirectly but systematically, is the classroom. Schools can provide an environment to minimize malicious competition, and moreover, provide a place where we can better learn to cooperate. Therefore, a more scientific teaching method is important. Under this situation, the Jigsaw technique was proposed (Elliot Aronson, 1978).

Based on the principle elements of cooperative learning proposed by Johnson and Johnson (1999), the Jigsaw technique is built using the following principles, and also has

its own characteristics.

1) Positive interdependence: the element of "required" interdependence among students, which makes this a unique learning method, as well as the interdependence that encourages the students to take an active part in their learning (Elliot Aronson, 1978).

2) Individual and group accountability: like a piece in a Jigsaw puzzle, every student needs to comprehend all parts of the information to make it a whole when they are in an expert group. After they return to the home group, they should be responsible for sharing what they have learnt in the expert group that ensures successful learning.

3) Interpersonal skill: this technique is not only focused on fixed knowledge learning, and it aims at capacity building. The students can get some cooperative skills from the learning process.

4) Positive interaction: Jigsaw is a strategy that emphasizes cooperative learning by providing students an opportunity to actively help each other to build comprehension (Marhamah & Mulyadi, 2013). Face-to-face study is necessary for the students to encourage and support each other.

5) Group processing: this is a group-based technique, so whether the students can get good outcomes is determined by which processes work well. It should be altered when outcomes are not good.

2.1 Process of Jigsaw activities

The original Jigsaw model has three stages: 1) students are divided into home groups and expert groups, 2) a short time later they return back to the home group and share the information that they learnt from the expert group, and 3) students participate in a test about what they have learnt from the two groups.

Number	Procedure	Group	Activity
1	Grouping	Home group	2-6 people are grouped
			Learn the same topic
			Research the sub-topics of the unit assigned to them
		Expert group	Come together with the students researching the same topic
			Share the research results with each other
			Amend the ideas about how to explain the topic to their classmates
2	Return to the home group	Home group	Share what they have learnt with each other Teach all parts of unit to each other
3	Evaluation		Partake in a test covering all units

			The scores gained in the test are assessed individually

(Akif, 2016)

3. Literature review

The special characteristics are found in the learning process.

Everyone in Jigsaw is a part of a larger academic puzzle. Each student teaches the other group members a part of the puzzle, and has a responsibility for ensuring that everyone can learn all component parts. Everyone is in the position to bring unique knowledge that allows a group member to treat each other as a reference.

The Jigsaw technique has quite flexible practices with limitless variations. In other words, although the number of students and topics are fixed, they can be improved in various forms. It also can be used across many different subjects.

To date, the following seven types of Jigsaw techniques have been proposed:

1) Original Jigsaw (Aronson, 1978)
2) Jigsaw II (Slavin, 1987)
3) Jigsaw III (Stahl, 1994)
4) Jigsaw IV (Holiday, 2000)
5) Reverse Jigsaw (Hedeen, 2003)
6) Subjects Jigsaw (Doymus, 2007)
7) Communication Jigsaw (Yoshida, 2018)

From Jigsaw II to Communication Jigsaw, all of these are based on the structure and principles of the original Jigsaw. The above-mentioned techniques basically resemble each other except that there are small procedural differences among them. The intended aim of each Jigsaw method and the results obtained are different, and they exist independently as a variant of the original Jigsaw.

The students are initially divided into groups. Then, the academic material is divided into subtopics that are assigned to the members of each group. After students report the results of their investigation and discuss with their home group, they are reorganized into expert groups. These new expert groups discuss their shared subtopic toward gaining complete knowledge on the entire topic. The students then return to their original group to report on the conclusions of each subtopic and assimilate what they have learnt (Yoshida, 2018).

4. Comparison of Jigsaw systems

The following Table 1 shows a comparison of previously proposed Jigsaw methods based on lesson processes.

Table 1 Comparison of Jigsaw types

Step	Class Process	Jigsaw I (Sahin, 2010)	Jigsaw II (Turkmen, 2015)	Jigsaw III(Turkmen, 2015)	Jigsaw IV (Turkmen, 2015)	Reverse Jigsaw (Doymus, Karacop, & Simsek, 2010)	Subject Jigsaw (Sezek, 2013)	Communication Jigsaw (Yoshida, 2018)
1	Beginning	->	->	->	Introduction	->	->	->
2	Original Group	Formation of home group	->	->	->	->	->	->
3	Assignment	Each member has different topic	->	->	->	->	All members of a group assigned same topic	Each member has different topic
4	Homework	->	->	->	->	->	->	Show indicators that students investigate
5	Expert group	Formation of expert groups	->	->	->	->	Involves mixing both the subtopics and the students are Jigsawed	Homework is to write a report
6	Supplement	->	->	->	->	Provide explanation to all students	->	->
7	Quiz or test	Group answers expert questions prior to returning to home groups	->	->	->	->	->	->
8	Evaluation	->	->	->	->	->	->	Peer-evaluation
9	About expert group quiz or test	->	A test of expertise is given to expert groups before they return to their home groups	->	Quiz on material in the expert groups checking for accuracy	->	->	No tests and quizzes

10	Home group	Student return to home groups sharing their information with group members	->	->	->	->	->	->
11	About accuracy group quiz or test	->	->	->	Quiz on material shared checking for accuracy groups	->	->	No tests and quizzes
12	Review	->	->	Review process of whole group by Jeopardy or Quiz Bowl. etc.; The process is evaluated by forms; Incorporate a form-based evaluative process	->	->	->	Self-initiated activities of commenting in online platform
13	Results	Individual assignment and grade	->	->	->	->	->	Paired evaluation is applied and this evaluation is also accepted by the tutor.
14	Summarize	->	->	->	Re-teach any material missed on assessment as needed (optional)	->	->	Have a reflection session with a teacher and all students
15	Outcomes	->	->	->	->	Focuses on their interpretation; Achieve student comprehension of the instructor’s material	->	->

16	Extension activities	->	->	->	->	->	->	Allow students to access other original written resources; Allow access to all subtopics

As mentioned in the three aims outlined above, the first aim of this review study is to compare variations of existing Jigsaw strategies in terms of procedures for the class process.

4.1 Development differences in Jigsaw process are listed in the following steps.

1)

Beginning: In Jigsaw IV, the teachers introduce what the concept of Jigsaw is and how to use it; the aim of this is to direct the students' attention on the chapter before the study session when they are organized in their Jigsaw groups. This also allows students outside of the class to be connected; perhaps a student does not understand about Jigsaw, but they still can enter the class and communicate according to this model. Perhaps cross-learning can be applied among different students and different classes.

2)

Original group: At the initial phases of Jigsaw, the number of students is 2-6/3-7, although it is fixed to 4 in Communication Jigsaw. It is not only convenient to gather in groups of 4, but it also can drive optimum efficiency as a home group.

3)

Assignment: In Subject Jigsaw, all members of a group are assigned the same topic; in the other Jigsaw types, each member has a different topic.

4)

Homework: In Communication Jigsaw, the students' homework is to write a report, and they can take the report back home and search for information from the internet. This is an automatic study process, and students will present the findings of their investigation in the class

5)

Expert group: The students researching the same topic gather together as a new group in the original Jigsaw method. In Subject Jigsaw, both the students and the topics are divided, which resembles pieces of a Jigsaw puzzle, and all students are mixed in the class. In Communication Jigsaw, homework is assigned to the student whereby they must write a report after the discussion in class. The report that they have written will make it convenient for their future communication.

6)

Supplement: In Reverse Jigsaw, the teacher will provide an explanation to all students ensuring they get accurate information.

7)

Quiz or test: The group answers expert questions prior to returning to home groups.

8)

Evaluation: The Communication Jigsaw has Peer-evaluation added into the discussion. Compared with the replacement of the expositor in the expert group, the explanation in the home group is more important. In other words, the students have to spend more effort on the report such that it can be easily understood by the other members.

9)

Expert group quiz or test: Jigsaw II adds the element of competition among groups for rewards based on test score improvement for group members. Unlike Jigsaw II, in Jigsaw IV, a test is applied in order to check whether the students can accurately learn and understand the relevant subtopics in expert groups. However, quizzes and tests are omitted in Communication Jigsaw.

10)

Home group: Students return to home groups and share their information with group members

11)

About accuracy group quiz or test: The second test in Jigsaw IV is used to check whether the students in Jigsaw groups have learnt the whole chapter or material. Until this step, the Communication Jigsaw type has no test and quiz; this method provides a comfortable and free environment for class communication.

12)

Review: Unlike in Jigsaw IV, the review process is evaluated by forms in Jigsaw III. In Communication Jigsaw, self-initiated activities of commenting are conducted online. In this section, the students' social circle and content of comments affect the feedback. The students develop skills in writing comments and establishing effective communication. Compared to what the students have learnt from class, the method of how to use it will be more important.

13)

Results: Initially, Jigsaw's evaluation criterion is individual assignment and grade. Jigsaw adopts paired evaluation and this evaluation is also accepted by the teacher. In addition, this evaluation is mainly produced from the expert group. The students evaluate each other by the group's standard.

14)

Summarize: In Jigsaw IV, the instructor summating and re-teaching the chapters that are unanswered and unlearnt come from the result of the evaluation. However, this practice is optional. If the student has already mastered what they have been taught, they can skip this step. This practice will be important for a student who has not reached a high level of achievement, especially prior to passing the next chapter. At the end of the

Communication Jigsaw class, teachers and all students have a reflection about the materials; this step helps the students to ensure that what they have learnt is comprehensive and accurate.

15)

Outcomes: Reverse Jigsaw is designed to accomplish a very different set of goals. While the Jigsaw technique is meant to achieve student comprehension of the instructor's material, Reverse Jigsaw has the aim to facilitate understanding of the range of participant interpretations on a number of topics through a highly participatory structure (Hedeen, 2003). Combining the sharing of information with shared responsibility for the learning process, Reverse Jigsaw weaves together principles of cooperative learning, adult learning, and democratic classroom structures (Schul, 2011).

16)

Extension activities: As the defining characteristic of Communication Jigsaw, students' writing sheets are used as resources for reports and discussions. This documentation method enables students to access all reports. In addition, a comment session was introduced to provide educational access to all subtopics (Yoshida, 2018) in order to encourage more communication and enhance the connection between what students learnt from the Jigsaw class and online feedback. As a Jigsaw user, the students can share their experiences and participate in the curriculum design.

5. University case studies of Jigsaw

Here, some teaching cases using Jigsaw in different subjects in university courses

1)

A study by Akif (2016) compared the effect of Jigsaw I technique from the cooperative learning methods and traditional teaching method on academic achievement and retrieval of Turkish teacher candidates in the matter of written expression. The sample of the study consists of 70 students studying at the Department of Turkish teaching in the academic year of 2009-2010. One of the classes was randomly specified as a control group [N=34], to which traditional teaching method was applied, whereas the Jigsaw technique was applied to the other class as a test group [N=36]. The study was predicated on the "Non-equal control group pattern". Learning styles of the groups were determined by the Kolb Learning Style Inventory [LSI]. Data about their academic success were collected through the Success Test for Written Expression [STWE] applied as a pre-test and post-test, and views of students about the Jigsaw I technique were collected through a questionnaire form related to the student's view [SVF]. Then, the responses obtained from students were analyzed. It was observed as a result of statistical analyses that there was not a significant

variation in favor of the test group in terms of academic success and stability between the test group and the control group in teaching the written expression subject. It was also identified that the students had positive views towards the Jigsaw I technique (Akif, 2016).

2)

A study by Özdemir & Arslan(2016) determined the effect of self-regulated Jigsaw IV on university students learning a new grammar structure within the FFL (English as a foreign language) learning process and also their attitudes towards the English course. The research was conducted with 40 students studying in two different prep classes at Bulent Ecevit University Foreign Languages College in the spring term of the 2011-2012 academic year. During the course, while self-regulated Jigsaw IV was conducted with the experiment group, a traditional method was performed in the control group. As quantitative data suggested, self-regulated Jigsaw IV significantly increased the students' academic achievements compared to the traditional method; however, it was slightly effective on their attitudes towards English. Qualitative data also suggested that students in the experimental group felt self-satisfied with their learning and they could use self-regulation skills in their autonomous studies (Özdemir & Arslan, 2016).

3)

A study by Doymus et al.(2010) investigated the effect of Jigsaw cooperative learning and animation versus traditional teaching methods on students' understanding of electrochemistry in a first-year general chemistry course. This study was conducted in three different classes in the Department of Primary Science Education during the 2007-2008 academic year. The first class was randomly assigned as the Jigsaw group, the second as the animation group, and the third as the control group. Students participating in the Jigsaw group were divided into five "home groups" since the electrochemistry topic is divided into five subtopics. Each of these home groups contained four students. The groups were as follow: ⑴Home Group A, representing the fundamental concepts of electrochemistry; ⑵ Home Group B, representing the electrochemical cell and energy source; ⑶ Home Group C, representing electrolysis; ⑷ Home Group D, representing Faraday's laws; and ⑸ Home Group E, representing corrosion. The home groups separated like pieces of a Jigsaw puzzle, and the students moved into Jigsaw groups consisting of members from the other home groups, who were each assigned a subtopic. For students in the animation group, their lesson focused on explaining the step-by-step process of electrochemistry using a computer-animated presentation. The main data collection tools were the Test of Scientific Reasoning and the Particulate Nature of Matter Evaluation Test. The results indicated that the Jigsaw and animation groups achieved better results than the control group (Doymus et al., 2010).

4)

Two university courses were selected for inclusion in the teacher of Yoshida's study. The courses had the following characteristics:

University: Chiba University, Chiba, Japan.

Course title: "International Understanding from Statistical Data" (a general education subject).

Grade of students: First-year undergraduates from four faculties.

Course periods: October -November 2016 (control group) and October-November 2017 (experimental group).

The following is a summary of the effects of Communication Jigsaw, particularly in the experimental group.

1) Communication Jigsaw encouraged the formation of a scholarly community of students in an unstructured and spontaneous communication environment provided by the comment session.
2) Practical ability was an important element in the comment session, whereby learning was not aimed at acquiring and facilitating deeper comprehension.
3) The comment session required students to increase their motivation. This part of Communication Jigsaw capitalized on how spontaneous self-directed learning happens (Yoshida, 2018).

The four examples presented above show the common characteristics of Jigsaw technology even in different steps. This technique is applied to various subjects and is gradually developing from the class practice. These examples proved that it has high researching value.

6. Remarkable differences in types

The Jigsaw technique has changed from a mechanical method to a model promoting social communication. It strengthens the connection between the knowledge that the students have learnt and the skills they will need in their future lives.

In Table2, we analyze the developing differences in several parts.

Table 2 shows the extracted indispensable factors, the basis of the Jigsaw method, the composition of the Jigsaw method, task sharing, and the communication during the process.

Across the various Jigsaw methods, the largest differences were noted in the

communication component. Therefore, it is important to assess the evolution of and differences in this development.

Table 2 Comparison of Jigsaw types in Learning

		Jigsaw I (Akif, 2016)	Jigsaw II	Jigsaw III	Jigsaw IV	Reverse Jigsaw	Subject Jigsaw (Doymus et al., 2010)	Communication Jigsaw
Basis of the Jigsaw method	Number of students in each group	Groups of 2-6 students are formed.	≥	≥	≥	≥	≥	Consists of 4 students
	Topic	Each member has different topic	≥	≥	≥	≥	Mixing the subtopics	Four topics can be chosen freely
	Evaluation	The scores gained in the test are assessed individually	Team competition is allowed	≥	Some quizzes are used to examine the study process	Student's achieve comprehension of instruction's material	Every unit groups complete the preparations and make a final presentation for the whole unit	Report sheet, comment sheet, final examination
	Purpose of the test/quiz	Evaluate the group mastery of the material	Adds the element of competition among groups for reward based on test score improvement	The test is the same as Jigsaw II , but the process is evaluated	The quiz is to check the part which are not taught is added to the process of	Test to facilitate understanding of the range of participant interpretations on a number of topics	The test is changed as a presentation, Testing is not limited to written	The final evaluation component has three parts and the paper test is of three parts.

			to group members	by forms.	instruction again.			
Composition of the Jigsaw method	Home group --whether the same	Students in the original group research the sub-topics of the unit assigned to them	≥	≥	≥	The unit of the lesson that will be taught in the classroom is separated into subjects. Then every subject is assigned to home groups	Home groups divided into several subgroups and assigned subtopics (students in same subgroup share the same subtopic)	4 students as a group choosing different topics
	About the topics	The subtopics are related to the course. They are independent of each other but belong to the same topic	≥	≥	≥	≥	≥	The link data of the topics are provided
	Expert group	Come together with				Two or more subjects are		The same as Jigsaw I

		the students researching the same topic and form a new group	≥	≥	≥	brought together and second subject groups are formed. Every second subject groups consist of half the number of students in the first subject groups.	≥	
	Home group	The initial group	≥	≥	≥	≥	≥	≥
Task sharing	Home group					Every group investigates the assigned subjects, learns the subjects, completes the assignment, and makes presentations.	≥	The teacher shares the concept of the Jigsaw technique and shares all of the information about the whole topics.
	Expert group	Students share the research results with each other and exchange ideas about	≥	≥	≥	Every formed group investigates their own assigned subject, learns the subject,	≥	Students share their prepared information about the chosen topic. At the same time, they share their research by twitter.

		how to explain the topic to their classmates.				completes preparations, and makes a presentation.		
	Home group	Share their studies with each other.	≥	≥	≥	≥	≥	≥
Communication In the process	Home group	The teacher assigns the task to the student.	Same as Jigsaw I.	Same as Jigsaw I.	Teacher conducts activities to present the lesson plan and the materials to be studied by the class.	Teacher explains the unit of lessons, then separates them into subjects.	Same as Jigsaw IV.	Besides introducing the lesson plan and topics, the teacher has prepared the introduction and relevant links search for outside of the class.
	Expert group	Students becoming experts in a topic play an essential role in learning among their classmates.	≥	≥	≥	≥	≥	Students discussing all of the information that they have searched before with others allocated the same topic. Students have to try upload some thoughts about their topic onto twitter
	Home group	Among the students	≥	≥	≥	≥	≥	Adds communication between the teacher and

								the students

6.1 Clear differences and modifications among the different Jigsaw methods

6.1.1 Basis of the Jigsaw method

At of the first stage of the Jigsaw method, 2-6 people are formed as a group; the group size in Communication Jigsaw is fixed at 4 people because it not only convenient for the nearest seat but also this group can efficiently achieve outcomes.

As the important materials of this method, the topics and groups are mixed at the beginning of Subject Jigsaw, whereas in Communication Jigsaw, the topics are fixed in 4 subtopics within the group. This suits the setting for the number of students.

How to evaluate the final outcome is also an important part of this method; the test score is average in Jigsaw I, whereas team competition is allowed in Jigsaw II. In Jigsaw IV, some quizzes are used to examine the study process, and in Reverse Jigsaw, the aim is to focus on achieving the student's comprehension of the instructor's material. In Subject Jigsaw, every unit group completes the preparations and makes a final presentation of the whole unit. In Communication Jigsaw, the final score is based on three aspects: report sheet, comment sheet, and final examination. The evaluation becomes more and more comprehensive than the other steps.

Nearly all of the Jigsaw methods use a test during or at the end of the process. Every Jigsaw type has its own presented aims, so the comparison of differences can aid in overseeing the development of communication.

As shown in Table 2, the examination type has changed from a paper test only to a presentation and then gradually reformed in the process. In Communication Jigsaw, a final test forms a component of the evaluation process. The test can help the students to be more interactive with each other as a group. It is no longer the only standard and gives students more time to communicate with classmates and the outside.

6.1.2 Composition of the Jigsaw method

The home group: From Jigsaw I to Jigsaw IV, the students in the original group research the sub-topics of the unit assigned to them. In Reverse Jigsaw, the unit of the lesson that will be taught in the classroom is separated into subjects. Then, every subject is assigned to a home group. In Communication Jigsaw, four students form group, and each student chooses a different topic from four allocated topics.

The first several Jigsaw methods use the same subtopics in the home group. In Communication Jigsaw, each home group member chooses a different subtopic.

From Jigsaw I to Subject Jigsaw, the subtropics are relative to the course. They are independent of each other but belong to the same topic. In Communication Jigsaw, the

teacher introduces every subtopic and provides information links to the students. Student are then asked to write a sheet and they must search for some information from the internet outside of class.

The expert group: In Reverse Jigsaw, two or more subjects are brought together and second subject groups are formed. Every second subject group consists of half the number of students in the first subject groups. In the other Jigsaw methods, students researching the same topic come together and form a new group, called expert group.

The home group: Students return to their initial group and share the information learnt from the expert group.

6.1.3 Task sharing

The home group: In the first six steps, every group investigates the assigned subjects, learns the subjects, completes the assignment, and makes presentations. In Communication Jigsaw, the teacher shares the concept of the Jigsaw technique and shares all of the information about the whole topic. The topics are linked to the UNSCO index.

The expert group: From Jigsaw I to Jigsaw IV, the students share their research results with each other and exchange ideas about how to explain the topic to their classmates. In Reverse Jigsaw, every group formed to investigate its own assigned subjects learns the subjects, completes the preparations, and makes presentations. In Communication Jigsaw, the students share their prepared information about the topic that they have chosen. At the same time, they share their research by twitter to connect with the community outside of class.

The home group: Students share what they have studied from their expert group with each other.

6.1.4 Communication in the process

The home group: In Jigsaw I,II, and III, the teacher assigns the task to the student, and there is no active communication with each other. In Jigsaw IV, the teacher additionally presents the lesson plan and the materials to be studied by the class expecting to arouse the learning motivation. Reverse Jigsaw and the Subject Jigsaw is similar with Jigsaw IV. In Communication Jigsaw, besides introducing the lesson plan and the topics, the teacher has prepared the introduction and related links; the students not only receive the topic information from the teacher, but they can independently search and complete the information sheet using the internet outside of the class. All of this is to ensure that the class process goes smoothly and the students have more time to discuss with each other.

The expert group: In all of the Jigsaw steps, the students becoming experts about a topic play an essential role in the learning process of their classmates. Communication Jigsaw

adds that the students have a try to upload some thinking about their allocated topic onto twitter.

The home group: In the first six steps, the students exchange what they have learnt from the expert group before a test at the final stage. In Communication Jigsaw, the teacher will summarize all topics of relative knowledge. Among the students, they evaluate each other using a comment sheet.

In the process of this analysis, we have seen the changes in the communication component. The Jigsaw method at each stage has adjusted the expected goals, and the intermediate process is also changing. The increase in the communication component has improved the confidence and enthusiasm of students and improved the level of cooperation technology.

7. Discussion

Although this method has been proven to be an efficient educational method that can be applied to different subjects, there are some inefficiencies, some of which have been improved in the development of the process, but some can still be improved in the future. In the Jigsaw I technique, the students becoming expert about a topic play an essential role in the learning process of their classmates. However, taking extra time and not being appropriate for grade one students are the negative aspects of this technique. (Doymus et al., 2010; Slavin, 1995)

Despite the fact that the effectiveness of the Jigsaw I technique has been revealed in several studies, the finding that this technique is not more effective than conventional teaching may be because the students were not ready for cooperation, the number of students with low success was high and such students did not contribute to the group, the students were not able to get rid of the habit of being in teacher-centric learning that has continued for years, the students have poor social skills, and some students in the group were dominant whereas some were passive. Because of these reasons, techniques based on cooperative learning should not be applied unless the students are well trained about cooperative learning approaches (Akif, 2016).

In Communication Jigsaw, there are two insufficient areas, one is that the creation of new groups (for a new study theme) is random and the students must find new members for their new group, which takes up some time and often causes some state of confusion. The other is that the type of discussion is singular (which can be unstimulating for students) and students do not know how to make a good comment on twitter since they lack the experience.

8. Conclusion

According to the review of previous studies of the Jigsaw method, the variety of Jigsaw methods has been investigated and their characteristics compared. The first six steps of the Jigsaw technique help the students to improve in learning motivation and academic outcomes. Communication Jigsaw focuses on developing lifelong abilities such as communication, research, and analysis ability. However, this method also needs improvement in some respects, and I propose some improvement to the methods below in future issues.

9. Future Issues

When the Jigsaw technique is developed into Communication Jigsaw, writing sheets have been added, and these can be easily exchanged among students, communicated with others as a business-like card, calculated and analyzed as a part of paper data.

9.1 Suggestions for improvement based on issues with current methods.

9.1.1 Pre-class preparation

This work requires the teacher to make more effort in the course arrangement pre-class and present the possible problem in advance. The selection and setting of topics are some of the key points to stimulate the students' interest. It has not ignored the introduction of how to run this method. If the students are not interested in this new technique and the relative topics, they will refuse to accept this method at the beginning. A structured curriculum set reduces the waste of class time and allows students to participate in the next process as soon as possible.

9.1.2 Grouping

There is no fixed standard to make different groups. However, how to quickly make a new group and the balance of the group student’s ability is the key to ensure the continuation of the Jigsaw method. When the group is built and the next problem is presented, how to ensure everyone effectively participates during the Jigsaw process cannot be controlled.

Of course, this method needs to be applied over a long period, besides that, the teacher can prepare and present some videos introducing this method at the beginning of class to show to the class. When the students accept the concept of the Jigsaw technique in their minds, then they may be more willing to try the method.

9.1.3 Social skills learning

The Jigsaw technique is one type of cooperative learning. So, for the students who are dominant under the teacher-centered class, some may not initially accept the change to a student-centered class. Now, the knowledge about how to cooperate with others becomes necessary and these social skills will play an important role in the students' future. If the instructor can teach the students these skills at the initial stage of class, it will help most students use this method well in the subsequent lessons.

The next social skill is about how to use twitter well. Twitter is applied as a tool that can extend the connection with the outside. Communication Jigsaw class encourages the students to express their thoughts by composing a comment (called a 'tweet') and uploading it onto twitter, then everyone can collect the feedback and analyze the influence and how to communicate effectively with others. This step is very important. However, the method of how to flexibly apply this technique is difficult. Twitter has long established itself as the ultimate platform for sharing and exchanging feelings through social media. Composing a good tweet can be very challenging, especially understanding whether it will be trendy or not. Twitter is supposed to be enjoyable, and doing everything by the book, or in a very methodical or rule-driven way, may seem like hard work for a student. However, if the student really wants to be successful on the network, then they have to make extra effort. Some suggestions for composing tweets that will be widely viewed and engaged include the use of trending hashtags, images, viral words, brevity, humor, shortened URLs, and engaging, talkative, and non-lecturing tone.

The students should also control the number of submissions by considering the time lag for feedback/responses and avoiding recurrence of the content that they have directly learnt from the class. Students should incorporate cases from their daily lives into their tweets because people on Twitter resonate well with familiar things in life.

9.1.4 Method improvements proposed during student discussion

As seen in Table 2, as a group-based technique, the Jigsaw method has become more and more actively communicative and connected with the social scope. Based on Communication Jigsaw, some methods to enhance the cooperation and communication among students are proposed such as role-playing games, debating competitions, and interactive assignment modifications.

Role-playing games are games in which players assume the roles of characters in a fictional setting. There are several forms of role-playing games such as tabletop role-playing game (TRPG), live action role-playing (LARP), and game master (GM). For example, the expert group could set various roles for students to practice presenting the different topics based on the written report sheets.

Debating competition is a process that involves formal discussion on a particular topic. In a debate, opposing arguments are put forward for opposing viewpoints. Debates occur in public meetings, academic institutions, and legislative assemblies. It is a formal type of discussion, often with a moderator and an audience, in addition to the debate participants. Therefore, this may be a good discussion form for creating a communicative atmosphere among students.

Interactive assignment modification is a method to consider the discussion and exchange of feedback among the students when they share their written research sheets. In this manner, students can provide their opinions and comments after checking the assignment sheets of their groupmates, thereby helping to develop the students' critical thinking and communication skills.

The three methods suggested above should be set up before implantation into the curriculum.

We expect that Jigsaw methods can be applied in more subject classrooms in the future. Perhaps this technique can be connected with other educational theories in the near future and different characteristics compared to further improve this method.

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