Fostering students’ thinking skill and social attitude through STAD cooperative learning technique on tenth grade students of chemistry class

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Abstract. The aim of this study was to develop chemistry learning package using Student Teams Achievement Division (STAD) cooperative learning technique to foster students’ thinking skills and social attitudes. The chemistry learning package consisting of lesson plan, handout, students’ worksheet, thinking skill test, and observation sheet of social attitude was developed using the Dick and Carey model. Research subject of this study was chemistry learning package using STAD which was tried out on tenth grade students of SMA Trimurti Surabaya. The tryout was conducted using the one-group pre-test post-test design. Data was collected through observation, test, and questionnaires. The obtained data were analyzed using descriptive qualitative analysis. The findings of this study revealed that the developed chemistry learning package using STAD cooperative learning technique was categorized valid, practical and effective to be implemented in the classroom to foster students’ thinking skill and social attitude.

1. Introduction
Chemistry as a branch of science provides variety of learning experiences to mastery concepts and science processes. Thus, learning chemistry required skills, such as gathering factual information, processing information or making decision to solve problem in daily life. These skills are included in basic thinking skills that must be developed optimally by learners from primary to high education.

Thinking skills are the ability to use the mind and ratio optimally for information gathering, information processing, and decision making [1]. According to Wegerif [2], thinking skills are used to indicate a desire to teach processes of thinking and learning that can be applied in wide range of real-life.

Even though thinking skills are needed in learning science, they still do not get much attention from teachers, especially the teachers at SMA Trimurti Surabaya. This fact was supported by the results of preliminary test of thinking skills administered to eleventh grade students of SMA Trimurti Surabaya. The average score of test result is 32.7 showed that thinking skills of the students in SMA Trimurti Surabaya is considered low and less-developed. It means that thinking skills’ components including information gathering, information processing and decision making have never been practiced by the teachers to the students.

Beside, the preliminary observation indicated that the students’ social attitude is categorized as poor. It is based on the findings:
- Students seem embarrassed and hesitant to respond the teacher's question.
- Students often collect task not on time.
- Students often do not pay attention to the teacher's explanation, i.e. joking with their classmates or listening music using earphone when the learning process.
- Students are not actively discuss in group activities, yet only the group leader tend to be active.
- Students are frequently cheat during examination.
Due to such reasons, therefore, the thinking skills and social attitudes should be included in the learning process of science. The teachers then are expected to select an instructional technique that can promote thinking skills and social attitudes. One of the instructional models considered to facilitate the teacher in promoting students’ thinking skills and social attitudes is the STAD cooperative learning technique.

Student Teams Achievement Division (STAD) is a type of cooperative learning developed by Slavin [3] at John Hopkins University and is known as “student team learning” [4]. In STAD, students work in small heterogeneous groups (of five to six members) and help one another to comprehend the given materials. Slavin [3] listed three main concepts of STAD as team rewards, individual accountability, and equal opportunities for success. Team rewards are certificates or other awards which are given if a STAD group achieves higher than a predetermined level. In this way the spirit of positive competition is reinforced and all or none of the groups would be rewarded based on how they score. In terms of individual accountability the individual learning of each of the group members determines the success of the teams. Students tutor one another ensuring that all group members are ready for the test that students take individually. As for equal chances for success individual improvement of the students specifies their contributions to the group. In this method it can be guaranteed that all group members with different levels are equally motivated to do their best.

Many past studies in the field of STAD cooperative learning technique reported that such technique is very beneficial in learning science. Balfakih [5] revealed that students who were in the experimental group in which the STAD cooperative technique had been applied were more successful in terms of achievement and attitude towards the subject than the control group students on which traditional method had been applied. The similar study of STAD cooperative technique was performed in Pakistan by Iqbal [6] also explained that the results of achievement test on experimental group in which the STAD cooperative learning technique is implemented showed much greater than the control group which used traditional method. From the research conducted by Vaughan [7] that used the single group pre-test/post-test research design to investigate STAD effects on achievement variables by comparing scores of pre-test and post-test, it was found that there is an increase in post-test scores in all cases after STAD was implemented.

This present study focuses on whether the STAD cooperative learning technique can foster students’ thinking skills and social attitudes. Several empirical evidence stated that the STAD cooperative learning technique is effective to developed thinking skills and social attitudes of student. For instance, Johnson et al. [8] identified that cooperative learning environment involves students’ sense of responsibility, job division, interaction and communication, and mutual connection which are beneficial for each team member. Sharan and Sharan [9] also added that the use of cooperative learning also builds cooperative skills, such as communication, interaction, cooperative planning, sharing of ideas, listening, and taking turns. It is in line with statement proposed by Mergendollar and Packer [10] that teaching using cooperative learning promotes active learning in which students learn more when they talk and work together than when they listen passively. Consequently, it leads to academic gains, fosters respect for diversity, and advances language skills. A similar result was also shown in a quantitative research conducted by [11]. They identify variety outcomes of cooperative learning. The results are students exhibit better social skills and provide more social support for their peers, and also achievement increases for all ability levels (high, medium, low). Based on the overview stated before, then it can be concluded that the development of chemistry learning package using STAD cooperative learning technique is supposed to be effective in fostering students’ thinking skills and social attitudes.

2. Research method

The type of this research could be categorized as developmental research since it was aimed to develop chemistry learning package using STAD cooperative learning technique to foster students’ thinking skills and social attitudes. The chemistry learning package is consisting of lesson plan, handout, students’ worksheet, thinking skill test, and observation sheet of social attitude was developed by using the Dick and Carey model [12]. It was going to be implemented in the classroom to confirm its practicality and effectiveness. Research subject of this study was chemistry learning package using STAD cooperative learning technique which was tried out on tenth grade students of SMA Trimurti Surabaya. Tryout was conducted by using the one-group pre-test post-test design [13].
In this study, the developed chemistry learning package was applied in the three different classrooms or it was replicated three times to verify that the improvement of students’ thinking skills and social attitudes was due to the implementation of the STAD cooperative learning technique.

Variables observed in this study are the validity of lesson plan, handout, students’ worksheet, thinking skill test, and observation sheet of social attitude; readability of handout, readability of students’ worksheet, and completion of lesson plan (variables related to practicality of chemistry learning package); students’ thinking skills, students’ social attitudes, and students’ responses (variables related to effectiveness of chemistry learning package).

Data were collected using at least six instruments, i.e. expert appraisal sheet, readability questionnaire of the handout and students’ worksheet, observation sheet of lesson plan completion, thinking skill test, observation sheet of social attitude; and questionnaire of students’ response. Additionally, the collected data were analyzed with descriptive qualitative analysis.

3. Results and discussion
Before implementation, the developed chemistry learning package including lesson plan, handout, students’ worksheet, thinking skill test, and observation sheet of social attitude is validated by three experts. The results showed that the whole developed chemistry learning package was considered valid to be implemented in the classroom.

The readability of handout and students’ worksheet based on content and appearance aspects was interested by 90% of students. Additionally, based on explanation and illustration aspects was stated easy to understand by 93.5% of students. It indicating that the developed handout and students’ worksheet were appropriate to be implemented in the instruction.

The developed chemistry learning package that has been considered valid was then tried out in classroom to know its practicality and effectiveness. The tryout in this study was conducted in SMA Trimurti Surabaya to gather data about completion of lesson plan, students’ thinking skill, students’ social attitude, and students’ response.

3.1 Completion of lesson plan
The instructional activities by the teacher reflecting STAD cooperative learning technique were observed by two observers in terms four aspects, namely preparation, implementation, time management, and learning environment. The lesson plan was designed based on the phases of the modified STAD involving: clarify goals and motivate students, present introductory information, organize students into heterogeneous teams, facilitate learning materials, thinking skills and social attitudes, assess students’ mastery of chemistry concepts using individual test; and recognize group efforts. The observation results showed that completion of lesson plan was categorized excellent with the reliability of observation sheet of lesson plan completion was categorized reliable.

This means that the developed lesson plan using STAD cooperative learning technique can make it easy for teacher teach and facilitate students to successfully improve thinking skills and social attitudes. Such statement fits with the findings of this study that the instruction that was STAD cooperative learning technique, could assist students to learn thinking skills and social attitudes. This was supported by the results of: thinking skill test in which the average N-gain score was categorized as a high-g level and social attitude that observed during learning process was categorized good.

This is in line with that proposed by Slavin in Sanjaya [14] that there are two important reasons for cooperative learning used in education. First, some research results prove that the implementation of cooperative learning can improve student achievement as well as social relations ability, grow attitudes to accept lack self and others, and increase self-esteem. Second, cooperative learning can realize the needs of students in developing thinking skill and problem solving.

3.2 Students’ thinking skill
The obtained data from thinking skill test of X-2, X-7 and X-8 students in Table 1 were then processed using a standard data analysis technique that is the N-gain score (Hake, 1999). Such analysis was used to investigate whether STAD can effectively foster students’ thinking skills on tenth grade students of SMA Trimurti Surabaya.
Table 1. Average score of students’ thinking skill.

| Class | Average score | N-gain | Category |
|-------|---------------|--------|----------|
|       | Pre-Test      | Post-test |          |
| X-2   | 29.9          | 90.4   | 0.87     | High     |
| X-7   | 30.1          | 90.8   | 0.87     | High     |
| X-8   | 29.7          | 89.9   | 0.86     | High     |

Figure 1 showed that all of the average N-gain scores is categorized as a high-g level which means that the implementation of the STAD cooperative learning technique in the classroom has a great effect on the improvement of students’ thinking skills. It corresponds to the Husamah and Yuni's [15] study result which has proved better performance of students’ thinking skills using STAD cooperative learning technique than using conventional learning technique.

![N-gain score](image)

Figure 1. N-gain score of students’ thinking skill.

There are three main phases of STAD that play an important role in fostering students' thinking skills. Firstly, clarifying goals and motivating students. There are activities of teacher to explore students' prior knowledge, motivate students through demonstration activities, and clarify goals of learning. In this phase students are taught to gather information about what they will learn and are given an explanation of why it is important to learn. Secondly, presenting introductory information. There are activities of students in listening and giving attention on information presented by teacher and asking questions about the information want to know. In this phase, the students’ information gathered skills will be better. Thirdly, facilitating learning materials, thinking skills and social attitudes. There are activities of students in information gathering (formulating question and collecting data from observation or experiment), information processing (organizing data, analyzing data, and generating conclusion) and making decision appropriately in which all of such skills are thinking skills that should be mastered by the students.

According to Johnson [8], cooperative learning environment involves students’ sense of responsibility, job division, students’ interaction and communication, and mutual connection, which are beneficial for each team member. Communication and interaction provide the possibility for exchanging information which help students enhance their thinking skills and create new ideas. In line with that, Sharan and Sharan [9] revealed that through the implementation of STAD, not only can improve mastery of learning concepts but also thinking skills in information processing and decision making. Lord [16] also stated that students in cooperative groups interact with each other, share idea, search information, and make decision which may improve students' thinking skills.

3.3 Students’ social attitude

Based on the data obtained in Table 2 showed that students’ social attitudes of X-2, X-7, and X-8 including honest, responsible, disciplined, cooperative, and communicative that observed during learning process were categorized good respectively. In line with the result study of Ulansari and Bertha [17] showed that students’ social skills included communication, cooperation and responsibility on the implementation of STAD cooperative learning technique were categorized as positive.
Table 2. Average score of students’ social attitude.

| Indicator       | Class/Average score |
|-----------------|---------------------|
|                 | X-2     | X-7     | X-8     |
| Honest (H)      | 3.49    | 3.49    | 3.54    |
| Responsible (R) | 3.61    | 3.59    | 3.58    |
| Disciplined (D) | 3.25    | 3.24    | 3.28    |
| Cooperative (Coop) | 3.57 | 3.54    | 3.55    |
| Communicative (Comm) | 3.4   | 3.44    | 3.43    |
| Average score   | 3.46    | 3.46    | 3.48    |
| Category        | Good    | Good    | Good    |

Figure 2 showed that the most prominent social attitude indicator shown by the students during the instruction is "responsible".

This can be explained that one of the characteristics STAD cooperative learning technique is that each student is tested individually on the learning material without any assistance from other learners. The sum of the individual points in a group serves as the basis of the points allocated to the group. Group members compete with one another and earn certificates on the basis of how well the group performs. This impacts on the high students’ social attitude of responsibility during the learning that is actively discussing in group. As stated by Henley (2004) that students working in cooperative group are responsible not only to learn the material, but also to ensure their group members mastery all of the material.

Additionally, Nur [18] stated that cooperative learning aims not only to help students learn subjects to range from basic skill to complex problem solving, but also to develop social attitudes, i.e. intrapersonal and interpersonal skills. It fits with the statement which is proposed by Walters (2000), cooperative learning promotes social and interpersonal skills as students learn how to work together in diversity.

3.4 Students’ response

Data obtained from the questionnaire of students’ responses toward the developed chemistry learning package using STAD cooperative learning technique, is that students responded content, handout, students’ worksheet and instructional process are interesting, recent, and understandable. They also agree if the STAD cooperative learning technique to be implemented on their next chemistry lessons. The positive responses of students indicated that students were enthusiastic and motivated to follow instructional process reflecting the STAD cooperative learning technique. In other words, STAD is one of the teaching techniques that can motivate students to learn. This is in accordance with the research results from Aliyah [19] that students responded positively toward the implementation of STAD cooperative learning technique.
Some research on cooperative learning found that students who were given opportunities in the classroom to interact actively with classmates and teachers, would be happier and more satisfied with their learning experience than students who just read or listen to the given materials [8]. Bligh [20] also concluded that students find satisfaction with activities that appreciate their abilities and involve them into cooperative learning processes.

4. Conclusion
The findings of this study indicate that the chemistry learning package using STAD cooperative learning technique was categorized valid according to experts' judgment. The learning package was categorized as appropriate to be implemented in the classroom by considering two aspects: the developed handout and students' worksheet were readable and appropriate to be implemented in the instruction and the completion of lesson plan was categorized excellent with the reliability of observation sheet of lesson plan completion was categorized reliable. The learning package was also categorized as effective to be implemented in the instruction by considering three aspects: the students' thinking skills showed significant improvement on pre-test and post-test because the average of N-gain scores were categorized as in a high-g level, the students' social attitudes including honest, responsible, disciplined, cooperative, and communicative that were observed during the learning process were categorized good, and the students provided positive responses to the implementation of the chemistry learning package using STAD cooperative learning technique.

Finally, the results of this study indicated that STAD had a positive impact on students' thinking skills and social attitudes. However, the positive effect could be strengthened by implementing STAD more widely. Therefore, further research dealing with STAD teaching technique on other chemistry topics using similar or different research design is required.

Acknowledgements

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