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Analysis of Student in Learning Thermochemical Materials through Lesson Study

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Abstract: Analysis of Student Activity in Learning Thermochemical Materials through Lesson Study. Lesson study is a learning strategy that emphasizes collaborative activities on planning (plan), implementation of learning (do), and reflection, with the aim of improving the quality of learning, so that students' learning activities and student learning outcomes become good. The purpose of this study is to analyze the activity and student learning outcomes through lesson study. Activities carried out in 3 (three) cycles. Based on the results of reflection and decisions taken by the model teacher, resulting in the application of different learning models from each cycle. It was concluded that in cycle 1 applying the demonstration method, cycle 2 of the Teams Game Tournament (TGT) learning model, cycle 3 applying the TGT model combined with the LCC method. The learning process with the implementation of Lesson Study in Thermochemical material can improve the activity and learning outcomes in the XI IPA class of SMA Muhammadiyah Gubug, Grobogan Regency, 2018/2019 school year. The recommendations of this study are the need for application of other methods in learning Thermochemical content, and comparing their effectiveness.

Keyword: Lesson Study, Activity, Thermochemistry

Abstrak: Analisis Keaktivan Siswa pada Pembelajaran Materi Termokimia melalui Lesson Study. Lesson Study adalah strategi pembelajaran yang menekankan aktivitas kolaboratif pada perencanaan (plan), pelaksanaan pembelajaran (do), dan refleksi, dengan tujuan untuk meningkatkan kualitas pembelajaran, sehingga keaktivan belajar peserta didik dan hasil belajar siswa menjadi baik. Tujuan penelitian ini adalah menganalisis keaktivan dan hasil belajar siswa melalui lesson study. Kegiatan dilaksanakan dalam 3 (tiga) siklus. Berdasarkan hasil refleksi dan keputusan yang diambil oleh guru model, dihasilkan adanya penerapan model pembelajaran yang berbeda dari setiap siklus. Disimpulkan bahwa pada siklus 1 menerapkan metode demonstrasi, siklus 2 model pembelajaran Teams Game Tournament (TGT), siklus 3 menerapkan model TGT yang dikombinasikan dengan metode LCC. Proses pembelajaran dengan implementasi Lesson Study dalam materi Thermokimia dapat meningkatkan keaktivan dan hasil belajar pada kelas XI IPA SMA SMA Muhammadiyah Gubug Kabupaten Grobogan, tahun ajaran 2018/2019. Rekomendasi penelitian ini adalah perlunya penerapan motode lainnya dalam pembelajaran konten Termokimia, dan membandingkan efektifitasnya.

Kata Kunci: *Lesson Study, Keaktifan, Termokimia*

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▪ INTRODUCTION

Chemistry is often seen as a difficult subject, (Bradley & Brand, 1985). The results of the observations obtained data where students tend to stay away to continue their study of chemistry (Sirhan, 2007). Learning chemistry will be easy, when it is related to what happens around students. Chemistry topics are generally related to the structure of the material, so that the chemistry subject becomes difficult for many students. Chemistry curriculum generally combines many abstract concepts, (Taber, 2002), it will be difficult to understand when these basic concepts are not sufficiently understood by students (Nicoll, 2001). This indicates that chemistry requires a high-level skill set (Taber, 2002). The chemical aspect requires a level of macroscopic and microscopic thinking (Bradley & Brand, 1985).

Biggs & Moore, (1993), said that students learn to get what will be achieved, which will have an impact on understanding what is obtained, and how students should learn. Teachers are required to design effective learning strategies. It is very important for teachers to know what students already know and how students acquire knowledge and predict ways in which learning can be made more effective (Sirhan, 2007).

The learning process is developing relationships between "islands" of knowledge. The teacher must link concepts, so that students can create a coherent whole of key ideas, which allows the development of simple learning with meaningful concept maps, (Otis, 2001). The main factors that affect attitudes towards a subject are the quality of teachers and the quality of the curriculum (Skryabina, 2000). Empowering the broader chemical community and being involved in a field that is currently growing rapidly, it is necessary to foster an accelerated chemistry learning movement, (Mater, & Coote, 2019).

Related to the above, research on student activity in chemistry learning is important to do. Increased student activity can occur through: appropriate teaching methods, illustrative examples, demonstrations, information materials for independent study, (Chlebounova, I., & Smejkal, 2019). The success of learning is also strengthened by the methods used and the modeling carried out by the teacher (Astuti, 2018).

Thermochemistry is a material that has many calculations and formulas that require student activity. The strategy is that the teacher provides a lot of training and students are encouraged to actively ask the teacher, and teachers are required to be more varied in teaching. Good learning methods can improve students' metacognitive skills, lesson satisfaction and intrinsic motivation (Chatzipanteli, at.al 2015). The results of observations obtained data: learning carried out by the teacher still uses the lecture, discussion, and question and answer method and there are no variations in other learning models or methods that are more innovative and fun. This situation causes students to be less active in participating in chemistry learning. Learning strategies are one of the ways that can be pursued, including through lesson study. This research results show that the collaborative context has an impact on improving the quality of teachers, and empirically by increasing student achievement (Chong, & Kong, 2012).

Lesson Study is an activity of teachers as educators as well as researchers, which have an impact on improving learning. Lesson Study is a collaborative process both

during planning (plan), implementing the learning process (do), and reflection (see). The reflection activity is a conference where the observer presents his analysis and interpretation of student behavior. Previously, the model teacher conveyed his impressions and responses to the learning he was doing. The final result of the reflection meeting resulted in recommendations for further learning improvements (Fujie, 2019). The results of this reflection will effectively improve teacher quality and promote teacher professional development, (Lomibao, 2016). Through lesson study, the quality of the teacher model can be obtained, because the reflection process becomes a means of introspection for teachers to teach better. This includes improvements related to strategy design and the adoption of teaching and learning activities and exploring ways to stimulate active learning by improving the quality of classroom interactions. Learning activities in the classroom can be alive, based on exploratory questions generated by students (Wu, & Shah, 2004; Teixeira-Dias, at.al 2005).

The background above is the basis for the use of Lesson Study in chemistry learning, Thermochemistry material for class XI IPA SMA Muhammadiyah Gubug, Central Java. It is hoped that students can participate in active learning, which has an impact on maximum learning outcomes. The purpose of this study is whether there is an increase in student activity and learning outcomes from cycles 1, 2 and 3?

▪ METHOD

This type of research uses descriptive analytic methods with qualitative and quantitative approaches. The main objective of the research, namely to describe and analyze the learning activeness of students through the implementation of lesson study. There are four steps in learning through this lesson study, namely planning (plan), observation and learning (do), and reflection (see). This research was conducted in three cycles.

The research subject was Muhammadiyah Gubug Senior High School, with the object being the behavior of class XI IPA 1 students and teachers as facilitators. When the research was conducted from September to November 2018. Sources of research data from the lesson study team consisted of: model teachers, other teachers, prospective teachers, lecturers and students. The research data were obtained from: observations during open class activities, documentation in the form of videos, field notes, questionnaires carried out by students. In addition, the activity and psychomotor data were added with the data from the questionnaire. The validity is done through triangulation of research methods. The lesson study cycle is illustrated as follows:

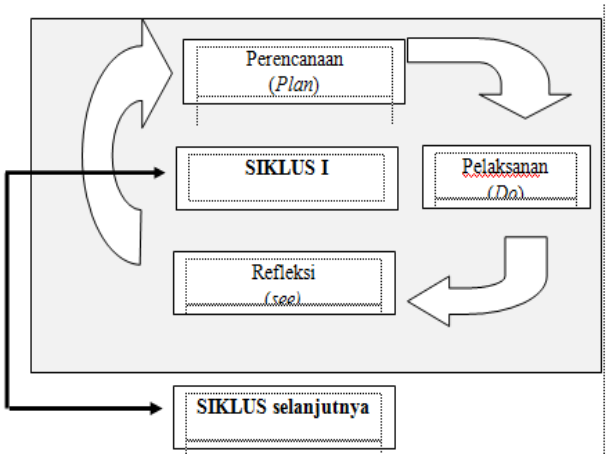


Figure 1. Implementation Flow of *Lesson Study*

The results of the activeness and psychomotor assessment scores were then categorized based on the value intervals. In conducting the assessment, 4 interval scales are used, namely: (1) 0.00-1.00 (D / Less); (2) 1.01-2.00 (C / Enough); (3) 2.01-3.00 (B / Good); (4) 3.01-4.00 (A / Very Good).

▪ RESULT AND DISCUSSION

The **CYCLE I**

Planning Stage *(Plan)*

Researchers with the lesson study team analyzed learning problems that occurred at the Muhammadiyah Gubug High School. Based on preliminary observations, it was found that student data were less active and the need to implement more varied learning methods. Collaboratively, the LS Team designed the chapter design (picture 2) and lesson design (picture 3).

CHAPTER DESIGN PADA MATERI TERMOKIMIA

(ENERGI DAN KALOR SERTAREAKSI EKSOTERM DAN ENDOTERM)

No	Materi	Jam	Format Materiinti • Cara Belajar	Sasaran / TujuanPembelajaran	Terlibat anMinat	Keaktifan Berpikir	Proses	Mengamati / pahami	Cara Evaluasi
1	Sistem dan lingkungan	6 JP	○ Sistem dan lingkungan terdapat dalam kehidupan sehari-hari • Membangun konsep melalui pengamatan contoh-contoh ○ Sistem merupakan bagian objek yang diamati dan lingkungan merupakan bagian di luar sistem • Membangun konsep melalui demonstrasi yang guru lakukan	- Siswa dapat menjelaskan konsep sistem dan lingkungan melalui fenomena dalam kehidupan sehari-hari - Siswa dapat menjelaskan tentang konsep sistem dan lingkungan melalui demonstrasi menggunakan bahan-bahan sederhana yang ada dikehidupan sehari-hari	○	○	○	○	Seorang pedagang kaki lima menjual berbagai macam minuman salah satunya adalah minuman hangat. Pedagang tersebut, merebus air (H_2O) dan menyimpannya dalam termos agar tetap hangat. Dari ilustrasi tersebut, identifikasikanlah sistem dan lingkungan! Di rumah, Citra membuat makanan dari ketan dan menambahkannya ragi dan dibungkus dengan daun pisang sehingga menghasilkan tape danetanol. Berdasarkan cerita diatas, menurut kalian, manakah yang merupakan sistem dan manakah yang merupakan l ingkungan?

Figure 2. *Chapter Design* of Themokimia *Material*

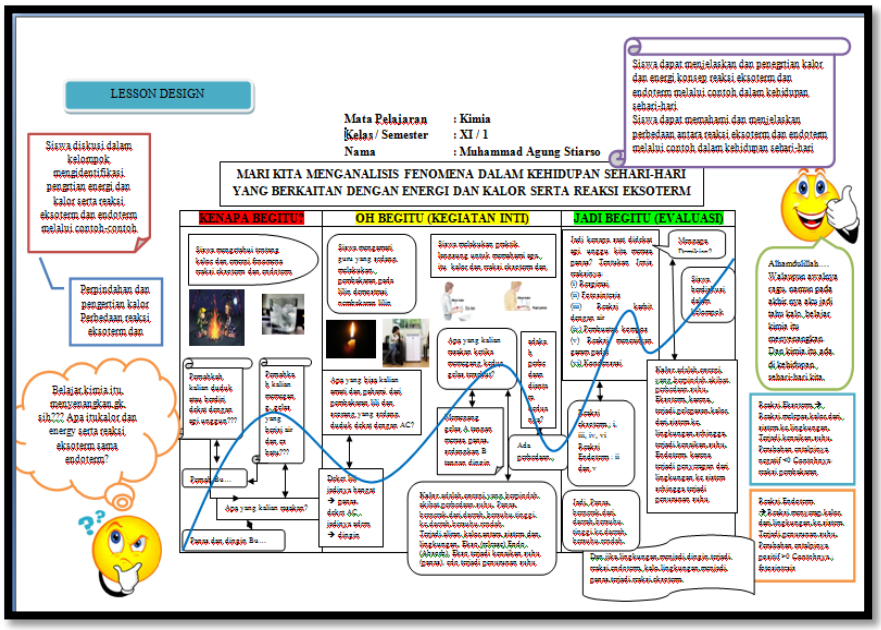


Figure 3. *Lesson Design* of Thermokimia Material

Implementation Stage *(Do)*

Sub-chapter material in cycle 1 is "System and Environment". The learning method applied by the model teacher is demonstration. The model teacher illustrates:

• A street vendor selling various kinds of drinks; one of them is a warm drink. The merchant, boil water and store it in a thermos to keep it warm. Until last night the water in the flask was still hot. From this illustration, please identify the related sub-chapters discussed.

• During camping, a camp fire is carried out. Students who are close to the fire will feel hot. From this problem, it is hoped that students can conclude the meaning of heat, and identification of systems and the environment.

The model teacher brought 2 bottles of ice. The first bottle is just filled with ice, and the second bottle of ice has melted. Students are asked to hold the bottle, and are asked to feel and respond to this phenomenon. The model teacher gives questions so that students calculate the heat released from a chemical substance based on a demonstration given by the model teacher. Heat is calculated using the formula ($q = m.c. \blacktriangle T$). Students are asked to work on the questions given by the teacher.

Reflection Stage (*See)*

The reflection team consists of 3 lecturers, model teachers, other teachers and 3 prospective teachers. The results of reflection from the documentation data, observations and field notes are: (1) there are still students' fear of answering; (2) students lack self-confidence; (3) there are still less interactive discussions; (4) students are still working individually in the questions. There is no cooperation formed between students; (5) only a few students could do the questions correctly; (6) some students lack focus and concentration. This can be seen from the students' blank stares and divergent minds (video data).

The results of the Reflection of the Lesson Study Team suggested a learning model that promotes discussion so that students are not individualistic in working on questions and students are more focused. Collaboratively mapping the existing learning models. Agree on the criteria needed, that a model is chosen for which there are activities: discussions, tournaments, games and encouraging motivation. There are 10 learning models, namely: Head Together Number, Head Number Structure, Student Teams-Achievement Divisions (STAD), jigsaw, Make A Match, Take and Give, Snowball, Talking Stick, TGT and Bamboo Dance.

The model teacher said that the next lesson used the Teams Game Tournament (TGT) model. Through the application of TGT students become more focused and participatory, to develop critical thinking and social skills, Gonzalez, Jennings, & Manriquez, 2014). There are 4 TGT activities including: team, games, tournaments, class presentations. This activity is in accordance with the recommendations from the reflection activity. The hope is that through the implementation of TGT, students are encouraged to be active in learning and able to compete with other friends, as well as better understanding of the material, (Dewi, 2016; Yasa, 2008).

Analysis of Student Activity

The indicators of student activity consist of: discussing, asking questions, engaging in learning, understanding material, and looking for answers. The highest score on the aspect of seeking answers (3.00) and the lowest score on the aspect of asking (2.00). The average

score of student activity in the first cycle (2.40), and in the "B / good" category. Complete data in Figure 4.

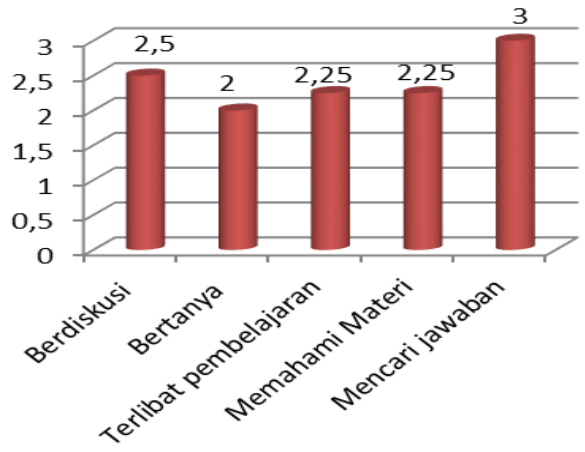


Figure 4. Grafic of Cicle Activity 1

The data above is corroborated by several research results: Erlinda, N, (2017) stated that the application of the TGT cooperative model can increase the activity and learning outcomes of grade I students of SMK Physics (Aji, Vita P, 2013). TGT is effectively used in learning (DeVries, 1976).

Analysis of Learning Outcomes (Cognitive, Affective and Psychomotor).

Cognitive assessment results are still lacking. The class average grade was 72.50. This value is still the predetermined standard value, namely 75. From the observations and videos, it was found that students' understanding of the concept was lacking. This can be seen from the video display, where many students still ask their friends and wait for answers from their friends who write on the blackboard.

Affective assessment data obtained from observations, documentation and field notes. Affective domain indicators include cooperation, cohesiveness, studying material (curiosity). Obtained data: (a) students are still lacking in cooperation and solidarity; (b) some students depend on answers from the model teacher or their friends who progress in working on the problems; (c) students are still looking for material information from the LKS book. The findings were that there were still students who could, but did not want to help their friends who couldn't.

Psychomotor indicators consist of: perception, readiness, imitation, and mechanical movements. In addition to the observation data, it was supported by filling out the instruments by students. The data percentage for each indicator is good (B), with an average value of 2.21. Complete data can be seen in Figure 5.

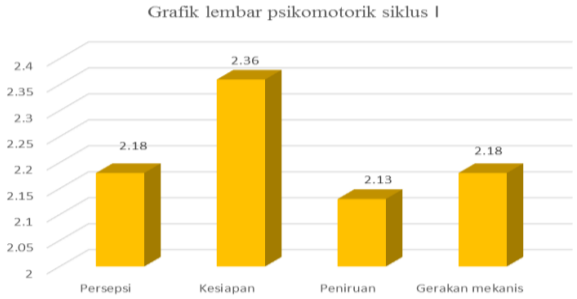


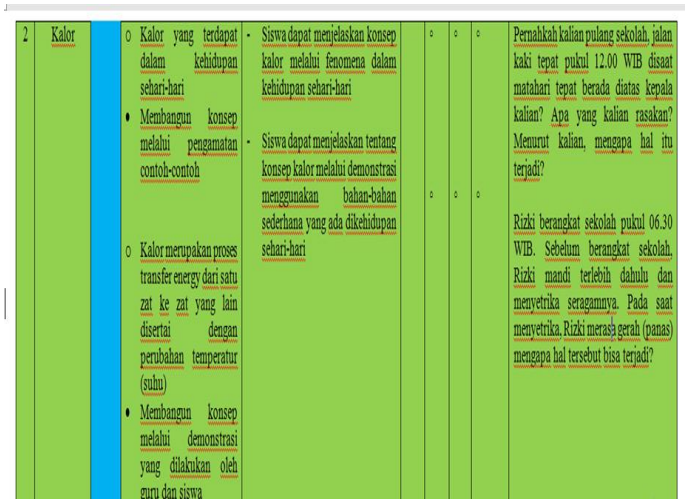
Figure 5. Graph of pskimotor ability

The TGT model selection is very precise. It is in line with the research results that TGT has encouraged students and teachers to be innovative and creative in the learning process. Learning through tournaments can improve students' understanding of mathematics and communication, (Veloo, Md-Ali, & Chairany, 2016). There is a positive influence on the TGT learning model on elementary students' motivation to learn science (Hakim, & Syofyan, 2017). Learning that applies the TGT model results in student achievement data, and students' intrapersonal intelligence is better when compared to using the Jigsaw method (Hidayati, Mardiyana, & Riyadi, 2014).

Cycle II

Planing Stage *(Plan)*

At the planning stage in cycle II, planning in the sub-chapter of heat material. The model teacher prepares and plans learning needs for the implementation of the Teams Game Tournament (TGT) model. The model teacher prepares a reward that will be given to students. The following is the chapter design used in learning heat material.



2	Kalor		o Kalor yang terdapat dalam kehidupan sehari-hari • Membangun konsep melalui pengamatan contoh-contoh o Kalor merupakan proses transfer energy dari satu zat ke zat yang lain disertai dengan perubahan temperatur (suhu) • Membangun konsep melalui demonstrasi yang dilakukan oleh guru dan siswa	• Siswa dapat menjelaskan konsep kalor melalui fenomena dalam kehidupan sehari-hari • Siswa dapat menjelaskan tentang konsep kalor melalui demonstrasi menggunakan bahan-bahan sederhana yang ada dikehidupan sehari-hari	◦ ◦	◦ ◦	◦ ◦	Pernahkah kalian pulang sekolah, jalan kaki tepat pukul 12.00 WIB disaat matahari tepat berada diatas kepala kalian? Apa yang kalian rasakan? Menurut kalian, mengapa hal itu terjadi? Rizki berangkat sekolah pukul 06.30 WIB. Sebelum berangkat sekolah, Rizki mandi terlebih dahulu dan menyetrika seragamnya. Pada saat menyetrika, Rizki merasa gerah (panas) mengapa hal tersebut bisa terjadi?

Figure 6. Chapter Design of the heating(Kalor) material .

Implementation Stage *(Do)*

Learning begins with the model teacher dividing the discussion group into 6 groups. Each group discussed the definition of endothermic reactions and exothermic reactions, thermochemical equations and standard enthalpy changes. The TGT type of cooperative learning consists of 5 stages, namely the class presentation stage, learning in groups (teams), games, tournaments, and team recognition. Hamdi, Suyanto, & Sukoco, 2017).

The model teacher divides the blackboard into 6 (six) parts. Each section has a score of 90, 80, 70, 60, 50, 40. The model teacher divides the quiz, and students are asked to do the quiz in groups. Students will answer questions quickly then paste the answers on the board, and give their own points / marks. At the end of the activity the teacher evaluates and jointly corrects student scores. Rewards are given to the group that has the highest accumulated value. The groups that received the reward were groups 5 and 2.

Reflectin Stage(*See)*

Reflections from observations, field notes and documentation through video

resulted in the following data: (1) the learning was fun because of the game stages and the tournament; (2) The ability to communicate / speak is still lacking so that learning seems to be dominated by a few students. (2) students have not taken turns in leading to answer questions. (3) there needs to be additional methods so that students are more courageous in expressing opinions and not only a few students who work on the questions given by the model teacher, as well as speaking / communication skills that need to be improved by students. (4) the arrangement of the tables when learning is too close together, making the learning take place less conducive. (5) Some students in the discussion joked with other group friends. (6) At the games stage, some students prevented other groups from pasting their answers on the blackboard, this condition made learning very busy. From these problems, it is necessary to improve the setting or arrangement of group tables so that the conditions for the learning atmosphere take place conducive.

Recommendations from reflection activities are: (a) maintaining the game, only need additional methods so that students are more daring to express their opinions; (b) speaking or communication skills need to be improved by students; (c) maintaining the discussion because the learning atmosphere in the classroom is good. Students become active in solving problems through discussion. From the results of interviews with students, the data obtained are: (a) students prefer to discuss in solving learning problems; (b) students feel happy about the game, because they are more enthusiastic in doing; (c) students like the tornament, because they are challenged to compete with other groups to be the best.

Learning through TGT can increase student interest in learning, it can significantly increase students learning to socialize while learning, educate students' understanding and communication, (Veloo, Md-Ali, & Chairany, 2016).

Analysis of Student Activity

Analysis of the activity aspect indicator obtained data: discussing (2.75), asking (2.00), engaging in learning (2.75), understanding the material (2.50) and looking for answers (3.00). The average number of values for the activeness aspect in the second cycle was 2.60; is in the "B / good" category. There was an increase of 0.20 from cycle I. The following is a picture of the activity aspect of cycle II.

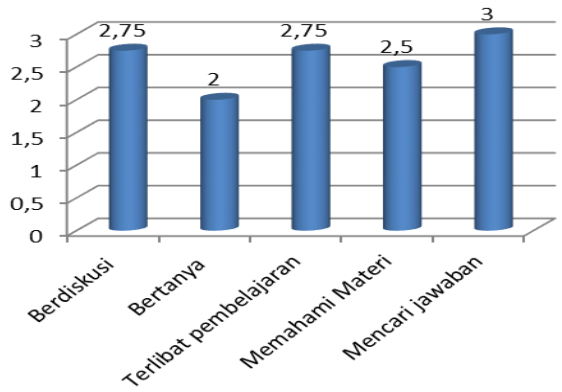


Figure 7. Graph of Cycle II Activity Indicators

Analysis of Learning Outcomes (Cognitive, Affective, Psychomotor)

The results of the cognitive assessment were still found 8 children who had cognitive ability scores below the standard. The class average score was 76.73, above the predetermined standard value. Based on the results of observations in each group, it was found that students were less involved when the group was working on it. This can be seen from the video, where some students hold cellphones, but it is not clear what they are looking for.

The results of the affective assessment analysis showed that: (a) the students' cooperation in the group was running well enough; (b) students carry out instructions from the model teacher well; (c) students have good enough motivation; (d) students search the internet for comparison with the material in the worksheets; (e) student cohesiveness in the group is still lacking, students still have a sense of individuality in working on the questions.

The data on the results of filling in the psychomotor aspects of students were good, with an average of 2.68. The value between indicators of perception, readiness, imitation, and mechanical movement was not too far away. Overall, there was an increase from the first cycle of 0.08, with the category of the value of "B / good". Complete data can be seen in the graph below.

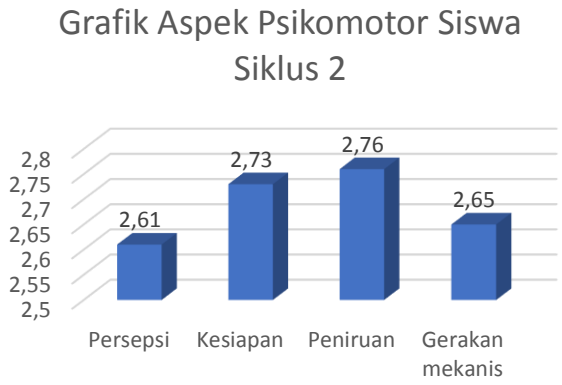


Figure 8. Graph of % Cycle II Psychomotor Indicators

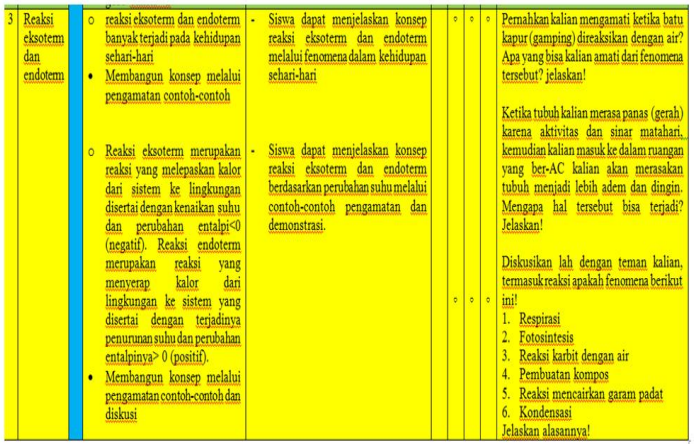
Based on the results of reflection in cycle II, it is still necessary to carry out cycle III. The observers agreed to continue to use the Teams Game Tournament (TGT) learning model because at the time of learning in cycle II it was good and stimulated students to be active in learning, but there needs to be a modification of the Teams Game Tournament (TGT) learning model which emphasizes the rubbing stage and tournamernt which serves to train students to dare to work on questions and submit answers individually in front of the class. Group discussions are required to be more active. The strategy is to encourage individual competition in groups. The goal is that individual students' speaking / communication skills are even more active, boldly expressing their opinions. The choice of method that will be applied by the model teacher is the application of the Teams Game Tournament (TGT) with a modification of the Quiz Competition (LCC) at the game and tournament stages.

CYCLE III

Planing Stage *(Plan)*

Learning in cycle III is the implementation of the Teams Game Tournament (TGT) model which is equipped with the LCC format. The teacher prepares 5 questions to work on in

groups. Each student in the group is responsible for presenting their answer. The following is the chapter design of the Endothermic and Exothermic Reaction material.



3	Reaksi eksoterm dan endoterm	○ reaksi eksoterm dan endoterm banyak terjadi pada kehidupan sehari-hari • Membangun konsep melalui pengamatan contoh-contoh	- Siswa dapat menjelaskan konsep reaksi eksoterm dan endoterm melalui fenomena dalam kehidupan sehari-hari	◦	◦	◦	Pernahkan kalian mengamati ketika batu kapur (gamping) direaksikan dengan air? Apa yang bisa kalian amati dari fenomena tersebut? jelaskan! Ketika tubuh kalian merasa panas (gerah) karena aktivitas dan sinar matahari, kemudian kalian masuk ke dalam ruangan yang ber-AC kalian akan merasakan tubuh menjadi lebih adem dan dingin. Mengapa hal tersebut bisa terjadi? Jelaskan!
		○ Reaksi eksoterm merupakan reaksi yang melepaskan kalor dari sistem ke lingkungan disertai dengan kenaikan suhu dan perubahan entalpi<0 (negatif). Reaksi endoterm merupakan reaksi yang menyerap kalor dari lingkungan ke sistem yang disertai dengan terjadinya penurunan suhu dan perubahan entalpinya> 0 (positif). • Membangun konsep melalui pengamatan contoh-contoh dan diskusi	- Siswa dapat menjelaskan konsep reaksi eksoterm dan endoterm berdasarkan perubahan suhu melalui contoh-contoh pengamatan dan demonstrasi.	◦	◦	◦	Diskusikan lah dengan teman kalian, termasuk reaksi apakah fenomena berikut ini! 1. Respirasi 2. Fotosintesis 3. Reaksi karbit dengan air 4. Pembuatan kompos 5. Reaksi mencairkan garam padat 6. Kondensasi Jelaskan alasannya!

Figure 9. *Chapter Design of Exotermic and Endotemicm Reacyion Matter*

Implementation Stage *(Do)*

The learning approach in cycle III trains students to convey their answers individually. Game and tournament models are modified with quiz competitions. Representatives of each group to come forward to represent their groups and answer questions given by the teacher. After answering the questions, the students paste the answers onto a written board that already has an existing score. Other group members are asked to come forward to work on other questions given by the model teacher. There are requirements that must be met, namely participants who progress must be other participants who have not advanced, so that every student has the opportunity to take part in games and tournaments. This can stimulate and foster the confidence of a student individually to answer questions or problems given by the teacher. This competition was followed by all participants.

Reflection Stage (*See)*

Refleski was followed by the entire Lesson Study team. At the beginning of the reflection activity the model teacher was asked to convey the impression of the day's learning. The following describes the expressions conveyed by the model teacher, after carrying out the learning in cycle 3. From these data it can be concluded that the implementation of lesson study in cycle III is good. The following describes the expressions conveyed by the model teacher and observer, after carrying out the learning in cycle 3. From these data, it can be concluded that the implementation of lesson study in cycle III is good. Here's what the model teacher said:

> *"Secara keseluruhan pembelajaran sudah berlangsung sangat baik, siswa sudah banyak yang memperhatikan guru saat pembelajaran. Saya selaku guru modelpun merasa sudah dapat mengendalikan proses pembelajaran yang berlangsung. Siswa aktif berdiskusi, bekerja sama dalam kelompok dalam memecahkan masalah yang diberikan oleh guru model, dan pembelajran yang berlangsung kondusif."*

Each observer was asked to submit their responses. Below is the presentation of the 3 observers, observers 1, 2 and 3:

> *"Pembelajaran berlangsung sangat baik. Siswa sudah berani menyampaiakan pendapatnya dan menjelaskan kepada temannya di depan kelas. Hal ini berbeda dari siklus sebelumnya, dimana siswa kurang berani menjawab pertanyaan yang diberikan oleh guru model.*

"Pembelajaran sudah berlangsug sangat baik. Siswa sudah terlibat aktif pada saat games, dan secara merata siswa sebagian besar (90%) siswa berani maju dan mengerjakan soal yang diberikan. Keberanian dan kepercayaan diri siswa dalam mengerjakan soal telah meningkat. Siswa sudah berani menanyakan kepada guru model dalam memecahkan masalah yang diberikan oleh guru model"

"Pembelajaran berlangsung sudah baik; siswa sudah aktif dalam melaksanakan pembelajaran. Pada saat pembelajaran, siswa sudah saling bekerjasama dalam kelompoknya. Siswa yang tidak bisa diajari oleh siswa yang sudah bisa. siswa tidak individualis dalam belajar."

Recommendations from the results of the reflection by the lesson study team obtained data: (1) the learning that took place was very good, (2) in learning the students had the courage to express their opinions and explain to their friends in front of the class; (3) the students' courage in answering the questions given by the model teacher; (4) the students are active in learning, games are not only a few students who progress and work on the questions given; (5) students' courage and self-confidence in working on the questions had increased; (6) students have the courage to ask the model teacher if someone does not understand; (7) there is cooperation and cohesiveness of students; (8) students in groups study together to work on the questions given; (9) students feel less individual, with students who cannot understand the material explained by students who can.

Student Activity Analysis

The value of each indicator on the aspect of activity with an average value: discussing (3.37), asking (3.20), engaging in learning (3.10), understanding the material (2.89) and looking for answers (3.05). The highest score is on indicators of discussion, while the lowest is understanding the material. The average value of the activity aspect in cycle III was 3.25, categorized as very good "A", and an increase of 0.65 from cycle II. The complete data is shown in the image below.

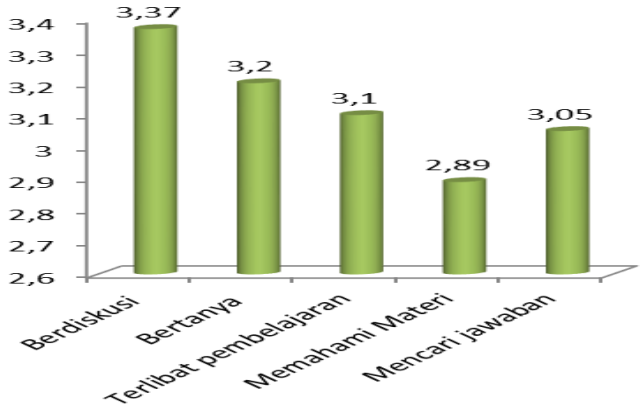


Figure 10. *Graph of Analysis Activity Cyclus III*

Overall, the activeness aspects of cycles 1,2 and 3 can be seen in Figure 11. Overall there is an increase in all indicators.

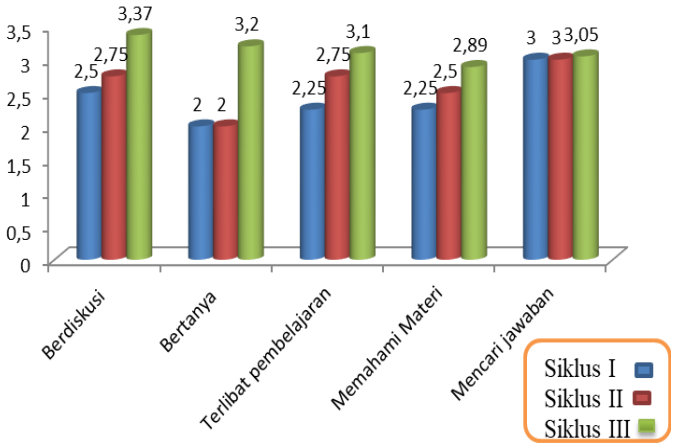


Figure 11. Graph of *Grafik Analysis activity each cyclus*

Student activity and learning outcomes are increased through education games (Yunus, & Sanjaya, 2013; Rohwati, 2012)). activity increases due to increased internal and external motivation (Effendi, 2016). External factors that affect student learning activeness are (1) social factors, such as teachers and peers, (2) non-social factors such as place and facilities (Maradona, 2016).

Analysis of Learning Outcomes (Cognitive, Affective, Psychomotor)

Based on documentation data and corroborated by observation, it was found that the result of the repeated value had exceeded the predetermined standard value, namely 78.8. This has increased from the previous cycle.

The assessment of the affective domain of the data was taken by means of field observations which obtained the data: a) group cooperation went quite well, students carried out instructions from the model teacher well; b) the cohesiveness of students in the group is good; c) students do not have an individual feeling in working out the questions; d) students also have good enough motivation in exploring the material; e) students search the internet for comparison with the materia**l in the worksheets.**

Each indicator aspect of the psychomotor assessment was good and the average score was 3.34. There is an increase from the previous cycle. Students' psychimotor skills are in the "A" category (very good). There was an increase in every aspect of the indicators from cycle I and II.

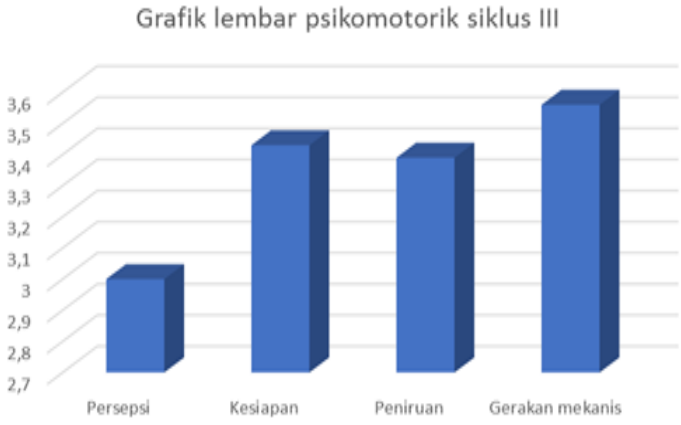


Figure 12. Result of *psicomotor syclus III*

▪ CONCLUSION

The results of the research and discussion can be concluded that:
First, based on the results of the reflections and decisions made by the model teacher, it resulted in the application of a different learning model for each cycle. It is concluded that in cycle 1 applying the demonstration method, cycle 2 the Teams Game Tournament (TGT) learning model, cycle 3 applying the modified TGT model with the Intelligent Quiz Competition (LCC). Second, the learning process by implementing Lesson Study in Thermochemical material can increase activity and learning outcomes in class XI IPA SMA Muhammadiyah Gubug Grobogan Regency, 2018/2019 academic year. As suggestion, It is necessary to implement the application of other methods in the learning of Thermochemical materials, and to compare their effectiveness.

▪ REFERENCES

Aji, Vita P. 2013. Implementasi lesson study berbasis sekolah untuk meningkatkan aktivitas belajar akuntansi siswa kelas X AK 4 Smkmuhammadiyah wonosari tahun ajaran 2012/2013. *Artikel*. UNY: Yogyakarta.

Astuti, P. S. (2018). Interactive lesson study as a competence indicator of prospective english teachers. *International Journal of Social Sciences and Humanities (IJSSH)*. https://doi.org/10.29332/ijssh.v2n2.115

Chatzipanteli, A., Digelidis, N., & Papaioannou, A. G. (2015). Self-regulation, motivation and teaching styles in physical education classes: An intervention study. *Journal of Teaching in Physical Education*, *34*(2), 333–344. https://doi.org/10.1123/jtpe.2013-0024

Chlebounova, I., & Smejkal, P. (2019). High school student's ideas about ideal chemistry lesson. In Rusek, M and Vojir, K (Ed.), *PROJECT-BASED EDUCATION AND OTHER ACTIVATING STRATEGIES IN SCIENCE EDUCATION XVI (PBE 2018)* (pp. 142–150). CHARLES UNIV PRAGUE.

Chong, W. H., & Kong, C. A. (2012, January 1). Teacher collaborative learning and teacher self-efficacy: The case of lesson study. *Journal of Experimental Education*. https://doi.org/10.1080/00220973.2011.596854

DeVries, D. L. (1976). Teams-Games-Tournament. *Simulation & Games*, *7*(1), 21–33. https://doi.org/10.1177/104687817600700102

Effendi, M. (2016). Integrasi pembelajaran active learning dan internet-based learning dalam meningkatkan keaktifan dan kreativitas belajar. *Nadwa*, *7*(2), 283. https://doi.org/10.21580/nw.2013.7.2.563

Erlinda, N. (2017). Peningkatan aktivitas dan hasil belajar siswa melalui model kooperatif tipe team game tournament pada mata pelajaran fisika kelas X di SMK dharma bakti lubuk alung. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, *2*(1), 49.

Fujie, Y. (2019). Lesson study. In *Education in the Asia-Pacific Region* (Vol. 47, pp. 105–123). Springer Nature. https://doi.org/10.1007/978-981-13-2632-5_7

Hakim, S. A., & Syofyan, H. (2017). Pengaruh model pembelajaran kooperatif tipe teams games tournament (TGT) terhadap motivasi belajar Ipa di kelas Iv Sdn Kelapa Dua 06 Pagi Jakarta Barat. *International Journal of Elementary Education*, *1*(4), 249–263.

Hamdi, A., Suyanto, M., & Sukoco. (2017). Perancangan game petualangan membatik berbasis model pembelajaran teams games tournaments. *Telematika*, *10*(1), 36–49.

Hidayati, N., Mardiyana, & Riyadi. (2014). Eksperimentasi pembelajaran matematika dengan model pembelajaran kooperatif jigsaw dan teams games tournament (TGT) ditinjau dari kecerdasan intrapersonal siswa. *Elektronik Pembelajaran Matematika*, *2*(2), 152–162.

Lomibao, L. S. (2016). Enhancing mathematics teachers' quality through Lesson Study. *SpringerPlus*, *5*(1). https://doi.org/10.1186/s40064-016-3215-0

Maradona. (2016). Faktor-faktor yang mempengaruhi keaktifan belajar siswa kelas IV b sd. *Jurnal Pendidikan Guru Sekolah Dasar*, *17*(5), 619–628.

Mater, A. C., & Coote, M. L. (2019). Deep Learning in Chemistry. *Journal of Chemical Information and Modeling*. https://doi.org/10.1021/acs.jcim.9b00266

Nicoll, G., (2001). A report of undergraduates' bonding alternative conceptions, International Journal of Science Education, 23(7), 707–730

Prihartini, D. Penerapan lesson study berbasis sekolah untuk meningkatkan kualitas pembelajaran sejarah pada siswa kelas Xi IPS 3 SMA Negeri 1 Rowosari Kabupaten Kendal Tahun Ajaran 2010/2011. *Skripsi.* FIS. UNNES: Semarang.

Rohwati, M. (2012). Penggunaan education game untuk meningkatkan hasil belajar ipa biologi konsep klasifikasi makhluk hidup. *Jurnal Pendidikan IPA Indonesia*, *1*(1), 75–81. https://doi.org/10.15294/jpii.v1i1.2017

S. R. Yunus, I. G. M. Sanjaya, B. J. (2013). Jurnal Pendidikan IPA Indonesia. *Jurnal Pendidikan IPA Indonesia*, *2*(2), 203–208. https://doi.org/10.15294/jpii.v4i2.4179

Santyasa, I Wayan. 2009 "Implementasi lesson study dalam pembelajaran". makalah, disajikan dalam seminar lesson study dalam pembelajaran bagi guru-guru tk, sekolah dasar, dan sekolah menengah pertama di kecamatan nusa penida, Tanggal 24 Januari 2009 di Nusa Penida.

Sirhan, G. (2007). Learning difficulties in chemistry: An Overview. *Journal of Turkish Science Education*, *4*(2), 2–20.

Taber, K. S., (2002). Alternative conceptions in chemistry: prevention, diagnosis and cure? London: The Royal Society of Chemistry.

Teixeira-Dias, J. J. C., Pedrosa de Jesus, H., de Souza, F. N., & Watts, M. (2005). Teaching for quality learning in chemistry. *International Journal of Science Education*, *27*(9), 1123–1137. https://doi.org/10.1080/09500690500102813

Veloo, A., Md-Ali, R., & Chairany, S. (2016). Using cooperative teams-game-tournament in 11 religious school to improve mathematics understanding and communication. *Malaysian Journal of Learning and Instruction*, *13*(2), 97–123. https://doi.org/10.32890/mjli2016.13.2.4

Wu, H. K., & Shah, P. (2004, May). Exploring visuospatial thinking in chemistry learning. *Science Education*. https://doi.org/10.1002/sce.10126

Yasa, Doantara. 2008. Aktivitas dan Prestasi Belajar. [Online]. Tersedia: http//ipotes.wordpress.com/2008/05/24/prestasi belajar.html.(diakses 7 juli 2018).