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The Combination of Problem Based Learning (PBL) And Team Assisted Individualization (TAI) To Learning Activities And Mastering of Hydrocarbon Competencies Class XI MIPA-4 Students of MAN Sampang.

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Abstract: The Combination of Problem Based Learning (PBL) And Team Assisted Individualization (TAI) To Learning Activities And Mastering of Hydrocarbon Competencies Class XI MIPA-4 Students of MAN Sampang. This research is a Classroom Action Research that aims to improve learning activities and students' competency mastery of hydrocarbon material through the application of a combination of Problem Based Learning (PBL) and Team Assisted Individualization (TAI). The subjects of this study were 23 students of class XI MIPA-4 MAN Sampang for the 2019/2020 academic year, consisting of 9 boys and 14 girls. This research was conducted in two cycles, each cycle carried out in 3 meetings. The activity stages of each cycle include action planning, action, observation, and reflection. The student activity data collection was carried out through observation. Competency mastery data is carried out using the technical competency tests in the form of subjective tests in the form of descriptions. The research data were processed and analyzed qualitatively. Based on the data analysis, it can be concluded: (1) Student's learning activity in cycle I was 76,43% and cycle II was 87,42% (2) The average value of student competency mastery in pre-cycle was 57,83, cycle I was 73,09 and cycle II of 80,48. (3) Classical completeness of student's learning in the pre-cycle was 34,78%, cycle I was 65,22% and cycle II was 86,96%

Keywords: the combination of PBL and TAI, learning activities, mastery of competencies

Abstrak: Kombinasi Problem Based Learning (PBL) Dan Team Assisted Individualization (TAI) Terhadap Aktifitas Belajar Dan Penguasaan Kompetensi Hidrokarbon Siswa Kelas XI MIPA-4 MAN Sampang. *Penelitian ini merupakan Penelitian Tindakan Kelas (Classroom Action Research) yang bertujuan untuk meningkatkan aktifitas belajar dan penguasaan kompetensi siswa pada materi hidrokarbon melalui penerapan kombinasi Problem Based Learning (PBL) dan Team Assisted Individualization (TAI). Subjek penelitian ini adalah siswa kelas XI MIPA-4 MAN Sampang tahun pelajaran 2019/2020, sebanyak 23 orang terdiri dari 9 orang laki-laki dan 14 orang perempuan. Penelitian ini dilaksanakan dalam dua siklus, masing-masing siklus dilakukan dalam 3 kali pertemuan. tahapan kegiatan tiap siklus meliputi perencanaan tindakan (action plan), tindakan (action), pengamatan (observation), dan refleksi (reflection). Pengumpulan data aktifitas siswa dilakukan melalui observasi. Data penguasaan kompetensi dilakukan dengan teknis tes kompetensi berupa tes subjektif bentuk uraian. Data hasil penelitian diolah dan dianalisis secara kualitatif. Berdasarkan analisis data dapat disimpulkan: (1) Aktifitas belajar siswa pada siklus I sebesar 76,43% dan siklus II sebesar 87,42% (2) Nilai rata-rata penguasaan kompetensi siswa pada pra siklus sebesar 57,83, siklus I sebesar 73,09 dan*

siklus II sebesar 80,48. (3) Ketuntasan belajar siswa secara klasikal pada pra siklus sebesar 34,78%, siklus I sebesar 65,22% dan siklus II sebesar 86,96%

Kata kunci: *kombinasi PBL dan TAI, aktivitas belajar, penguasaan kompetensi.*

▪ INTRODUCTION

Chemistry learning is an attempt to instill abstract chemical concepts in students. The concept of atoms, molecules, and how bonds occur between atoms are abstract chemical concepts. According to Hanson, et al. (2011) Abstract chemical concepts are generally difficult for students to understand.

Solving chemistry problems sometimes also requires math skills. Some chemical concepts require mastery of previous concepts as a prerequisite for learning them. The success of learning a chemical concept can depend on students' understanding and mastery of previous concepts. This condition is a challenge for teachers in instilling concepts in students.

The determination of specialization in MAN Sampang is based on the results of the test of specialization and the questionnaire on student interest. There are 4 classes for specialization in Mathematics and Natural Sciences, 2 classes for specialization in social sciences (IIS), and 1 class for specialization in religious studies (IIA), in addition to the results of specialization tests and student interest questionnaires, comparison of the composition of MIPA, IIS and IIA specialization programs, equal distribution of the number of students In each specialization program, the availability of teaching staff, limited facilities and infrastructure are factors that also determine the placement of students in a specialization class which sometimes overrides the specialization test results, so students in the Mathematics and Natural Sciences specialization may have low academic ability, interest, and motivation to learn in the subject. MIPA includes chemistry. This situation can have implications for student learning outcomes. According to Muderawan, et al. (2019) the abilities, talents, interests, and academic achievements of students do not always match the specializations of high school students.

12 out of 23 students (52.17%) class X MIPA 4 MAN Sampang have not yet achieved completeness in learning in the final assessment of the even semester of the 2018/2019 academic year. This situation shows that the competence of students in chemistry subjects is still low. Low chemical competence identifies students' low mastery of concepts in learning chemistry.

Good learning outcomes will result from quality learning activities. Quality learning depends on the role of the teacher in organizing the class as part of the learning process and students as subjects who carry out learning activities. Good preparation is needed for teachers to design learning activities to be carried out. Teachers must think about strategies, methods, and learning models that will be applied to learning a concept so that students do not have difficulty understanding the concepts being learned. Chemistry learning activities do not have to be done with experimental methods, but can also be done with other methods in accordance with the characteristics of the chemical concepts being studied. The application of appropriate strategies, methods, and learning models in accordance with the characteristics of the chemical concepts being studied can help and make it easier for students to master the concepts being studied.

Teacher creativity in presenting learning activities that are interesting, varied, and participation for students is needed to avoid student boredom in learning and to be able to accommodate various kinds of student learning styles. The learning activities that are

applied must be able to create educational interactions between students and teachers, students and students and students with other learning sources.

According to Duch in Aris Shoimin (2014), Problem Based Learning (PBL) is a learning model that makes real problems a learning context for students to learn critical thinking and problem-solving skills to gain knowledge. PBL makes classroom learning activities relevant to real life. The learning material comes from contextual problems. Problem-solving learning can improve students' critical thinking skills/abilities (Lidyawati, 2017); problem-solving and metacognitive skills (Siagian, et al. 2019); student learning motivation (Dayeni, 2017); activation of student learning (Siregar & simatupang, 2020); understanding of the concept (Pahlevi, et al. 2020; Rudibyani, et al. 2020); student learning outcomes (Desriyanti, et al. 2016; Dayeni, 2017; Lidyawati, 2017; Jami, 2020; Nirbita, 2020); communication skills (Pahlevi, et al. 2020) which in turn can improve student competence.

According to Salim and Hidayati (2020), learning chemistry often requires initial knowledge as a prerequisite for learning higher concepts. Initial knowledge is the ability in the form of knowledge and skills that students have acquired or mastered from previous learning activities. The research results of Salim and Hidayati (2020) concluded that initial knowledge has a significant effect on mastery of chemical concepts. Students with high initial knowledge show better mastery of concepts than students with low knowledge. Students with high initial knowledge find it easier to associate new concepts that are learned with concepts that have been mastered so that they will not experience difficulty learning at higher concepts than students with low initial knowledge.

Research results Budiariawan (2019) and Dyah, et al. (2019) concluded that learning motivation also had a significant effect on students' chemistry learning outcomes. Students who have high learning motivation can achieve optimal results than students with low learning motivation. Students with high learning motivation can carry out learning activities with full responsibility and confidence than students who have low learning motivation.

From the diversity of initial knowledge and student motivation in the learning class, it is hoped that the teacher can present learning activities that can accommodate differences in students in learning. The Team Assisted Individualization (TAI) learning model is expected to overcome individualization of learning by combining cooperative learning with individual learning. In TAI learning activities students are placed in heterogeneous small groups consisting of 4 to 5 students. Each member of the group has the same task in completing the assignment given by the teacher, but each student can have different learning speeds and abilities. The success of learning TAI is determined by the success of the group, students who have high abilities are also responsible for helping friends in the group who have weak abilities or skills so that weak students will be helped in overcoming their learning difficulties. The involvement of students as peer tutors will have an impact on the success of the group. Research by Huda, et al. (2005) concluded that the application of peer tutoring techniques in the TAI learning model was effective in improving student learning outcomes. The application of the TAI learning model can also increase student motivation (Saraswati, et al., 2018), learning activities (Hadi, et al. 2018), learning outcomes (Afrida, et al., 2017), and student self-confidence (Nasaruddin, 2020).

The combination of PBL and TAI is expected to have a mutual effect (interaction effect) on the activeness and mastery of student competencies and can overcome the deficiencies that exist in the partial application of PBL and TAI. The combination of PBL

and TAI is carried out by providing real (contextual) problems in the form of chemical products in everyday life that contain hydrocarbons. Students in heterogeneous groups learn to think critically, solve problems and gain knowledge by analyzing hydrocarbon chemical formulas, giving hydrocarbon names, and writing down hydrocarbon isomers. Individual success contributes to group success and learning success in the classroom.

▪ METHOD

The research method used was classroom action research (PTK), using the model of Kemmis and McTaggart. this model only requires one action per cycle. The action and observation stages are used as an inseparable unit of action. The action research cycle according to the Kemmis & McTaggart model can be seen in Figure 1.

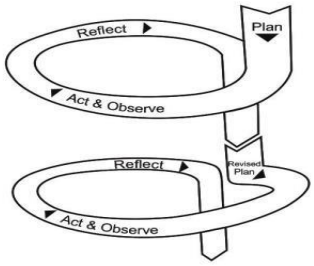

Figure 1. Action Research Model Kemmis & McTaggart (Pardjono, et al., 2007)

This research activity was carried out in 2 cycles, each cycle consisting of four stages of activity, namely; planning action, action, observation, and reflection. The four series of activities are carried out in a repeating cycle, each cycle is carried out in 3 meetings. The learning competence in cycle 1 is alkanes and cycle 2 is alkenes.

This research was conducted in a collaborative and participatory manner. Researchers are directly involved in all stages of research, including topic determination, problem formulation, planning, implementation, analysis, and research reports. To facilitate observation activities and to obtain objective data, this study involved 1 colleague, namely another chemistry teacher at MAN Sampang as a collaborator. Researchers act as learning designers, implements, and observers of the learning process. Peers act as observers of learning activities and students actively in learning. Researchers and collaborators alike conduct evaluations to determine improvement activities to be carried out.

The research sample was students of class XI MIPA-4 MAN Sampang, the school year 2019/2020 as many as 23 students consisting of 9 male students and 14 female students. Data collection techniques in this study were carried out through observation, document review, and tests. Student activity data were obtained through observation based on 5 student activities including: (1) readiness to take part in lessons, (2) forming groups, (3) group discussion, (4) asking or answering questions, (5) presenting the results of the discussion. Each activity is described in indicators, which in total there are 19 indicators of student activity in learning activities. Each indicator of student activity with a positive value is given a score of 1. The activeness of each student is determined by comparing the number of indicator scores obtained by students against the maximum score of all indicators.

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Table 1. Categories of Student Activeness and Classical Completeness of Learning

Percentage (%)	Category
90 – 100	Very High
80 – 89	High
65 – 79	Moderate
55 – 64	Low
0 – 54	Very Low

Source: Agung (2014)

▪ RESULT AND DISCUSSION

Pre-Cycle

The pre-cycle activity is in the form of determining heterogeneous groups based on the pre-test value of the alkane homologous series concept which is a prerequisite for learning hydrocarbons. The results of the pre-test were used to map the students' initial abilities into the categories of high, medium and low ability students. Students are categorized as having the highest initial ability if the pre-test score > average value, students have a moderate initial ability if the pre-test score = average value and students are categorized as having a low initial ability if the pre-test score < average value.

Based on the results of the pre-test, 5 heterogeneous groups were determined, each group consisting of 4-5 students in which there were students with high, medium and low initial abilities. Students with high initial abilities are used as group leaders with the hope that high-ability students can become the driving force in group discussion activities. Recapitulation of student pre-test results can be seen in table 2.

Table 2. Recapitulation of Pre-Test Results for Class XI MIPA 4 Students in MAN Sampang

Description	**achievements**
The lowest value	30
The highest value	80
Average Value	57,83
Students who complete (value ≥ 70)	8
Students who have not completed (value < 70)	15
Completion percentage	34,78%
Percentage of incomplete	65,22%

The pre-test average score of 57,83 is still low and does not meet the specified minimum completeness criteria (KKM). 15 out of 23 students (65,22%) scored ≤ KKM, this condition shows that the initial ability of students in learning hydrocarbons is very low.

Cycle I

The first cycle activities were carried out on 08, 09, and 16 August 2019. Based on the observations of the observer in the first cycle of meeting 1, students appeared to be active in group activities. Students are active in studying the material and doing the exercises individually, but there are still 2 students who look not ready to take part in learning activities, they do other activities outside of learning activities and disturb other friends in their group. In group discussion activities by correcting each other's answers between students in the group to get the correct group answers, some students still seemed hesitant to give their answers to get input from the group, they were hesitant to ask about their work results and difficulties faced. Students with high initial abilities also seemed hesitant to ask about the difficulties faced by group members, as well as in providing explanations or opinions to group members. In general, students have not been able to adapt to their groups.

In different groups, group discussion activities are dominated by students with high initial abilities, other group members tend to be passive and entrust group answers to the group leader, they only copy group answers. Concept transfer activities between students have not yet been maximized.

Students in groups actively study the material and do the exercises individually before continuing group discussions. All students were in class before learning activities began, they had prepared learning needs and focused attention on learning activities. In group discussion activities by correcting each other's answers between students in the group to get the correct group answers, interaction/cooperation between group members in the group has been seen. Students with high abilities are willing to help overcome the difficulties of their group members. Group members experiencing difficulties are also willing to accept explanations/opinions conveyed by other members of the group. The results of observations of student activeness based on the activeness indicator in the first cycle of meeting 1 and meeting 2 can be seen in table 3.

Table 3. Student Activities in Cycle 1

No	Student Activity	Indicator	Score Indicator		Average Score Indicator	Percentage (%)
			Meeting 1	Meeting 2		
1	Readiness to follow the lessons	3	2,91	3,00	2,96	98.50
2	Forming groups according to the teacher's direction	4	3,26	3,35	3,31	82.63
3	Conduct discussions in an orderly manner in groups	4	2,91	3,30	3,11	77.63
4	Asking or answering questions	4	2,43	2,43	2,43	60.75
5	Presenting the results of the discussion	4	2,65	2,78	2,72	67.88
	Amount	19	14,17	14,86	14,52	
	Percentage (%)		74,57	78,21	76,42	

Table 3 shows the percentage of activeness of each student activity ranging from 60,75% - 98,50%. The highest percentage of activeness (98,50%) was in the aspect of readiness to take part in lessons and the lowest activeness of students (60,75%) was in the aspect of asking or answering questions. At the first meeting, the activity of the

students was 74,57% with the active category including moderate. The details of the student activity category were 6 students (26,09%) with very high activeness categories, 1 student (4,35%) with high activeness categories, 9 students (39,13%) with moderate activeness categories, and 7 people (30,43%) with low activity category.

At meeting 2 the percentage of student activeness was 78,21% with the active category including moderate. Details of the student activity category were 6 students (26,09%) with very high activeness categories, 1 student (4,35%) with high activeness categories, 12 students (52,17%) with moderate activeness categories, and 4 people (17,39%) with low activity category. The average percentage of activeness in the first cycle was 76,42% with the category of student activity in the learning class including moderate. From meetings 1 and 2 there was an increase in student activity by 3,64%.

The results of the chemical competency test in cycle I can be seen in table 4.

Table 4. Recapitulation of Competency Test Results in Cycle I

Description	Achievements
The lowest value	38
The highest value	100
Average Value	73,09
Students who complete (value ≥ 70)	15
Students who have not completed (value < 70)	8
Completion percentage	65,22 %
Percentage of incomplete	34,78%

Table 4 shows the range of student competency scores between 38,00 – 100,00. The average value of the chemical competency test for class XI MIPA 4 MAN Sampang was 73,09. The average value of chemical competence has fulfilled the KKM (≥ 70). In the first cycle competency test, there were 15 out of 23 students (65,22%) who had achieved mastery learning, and 8 out of 23 students (34,78%) had not achieved mastery learning. Because the percentage of completeness learning in cycle I is less than 85%, the classical completeness of learning in cycle I have not been fulfilled. Based on the classical learning completeness category, the learning completeness in the first cycle was categorized as low. The competency data of students from each group after learning the combination of PBL and TAI can be seen in figure 2.

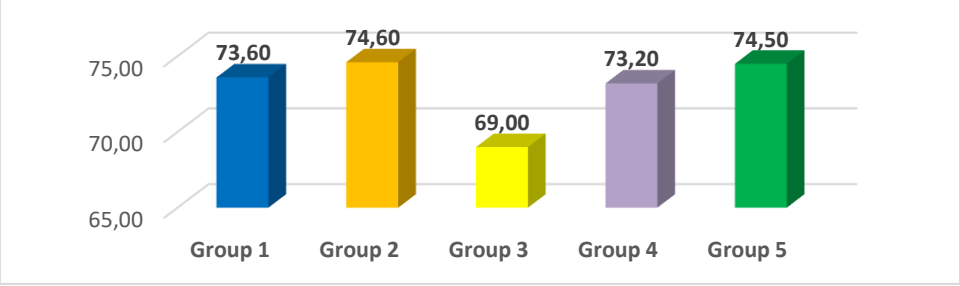

Figure 2. The Average Value of Student Competency Tests for Each Group in Cycle I

Figure 2 shows the average competency score of students in the group between 69,00 and 74,60. The highest average value was obtained by group 2 with an average value of 74,60 and the lowest average value obtained by group 3 with an average value

of 69,00. The mean scores of groups 1, 2, 4, and 5 have met the specified completeness criteria (≥ 70,00). The average value of group 3 has not met the completeness criteria.

Cycle II

Activities in cycle II were carried out on 22, 23, and 29 August 2019. At the first meeting, the students were seen to be active in group activities. Students actively study the material and do exercises individually by utilizing various existing learning resources in the form of textbooks, supporting books, and internet networks to be able to answer LKS activity 1.

Group discussion activities with mutual correction of answers between students in the group to get the correct group answers have seen interaction/cooperation between group members in the group. Students with high abilities are willing to help overcome the difficulties of their group members. Group members experiencing difficulties are also willing to accept explanations/opinions conveyed by other members of the group. Students no longer hesitate to show their answers to get responses from the group. They discuss the difficulties they face, give each other responses to existing problems to get an agreed group answer. Concept transfer activities between students have been going well. The results of observations of student activeness at meetings 1 and 2 in cycle II can be seen in table 5.

Table 5. Student Activities in Cycle II

No	Student Activity	Indicator	Score Indicator		Average Score Indicator	Percentage (%)
			Meeting 1	Meeting 2		
1	Readiness to follow the lessons	3	2,91	3,00	2,96	98,67
2	Forming groups according to the teacher's direction	4	3,65	3,74	3,69	92,25
3	Conduct discussions in an orderly manner in groups	4	3,39	3,52	3,46	86,50
4	Asking or answering questions	4	3,17	3,22	3,195	79,88
5	Presenting the results of the discussion	4	3,30	3,30	3,30	82,50
	Amount	19	16,42	16,78	16,60	
	Percentage (%)		86,42	88,31	87,37	

Table 5 shows the percentage of activeness of each student activity ranging from 79,88% - 98,67%. The highest percentage of activeness (98,67%) was in the aspect of readiness to take part in lessons and the lowest student activeness (79,88%) was in the aspect of asking or answering questions, but in this aspect, there was an increase of 19,13% compared to cycle I. Meeting 1 student activity amounted to 86,42% with the category of activeness including high. The details of the student activeness category were 7 students (30,43%) with very high activeness categories, 4 students (17,39%) with high activeness categories, 12 students (52,17%) with moderate activeness categories, and no students with the category low activeness.

At the second meeting, the percentage of student activeness was 88,31% with the activeness category including high. Details of the student activity category were 8

students (34,78%) with very high categories, 8 students (34,78%) with high activity categories, 7 students (30,43%) with moderate activeness categories, and no students with active categories low. The average percentage of activeness in cycle II was 87,37% with the category of student activeness including high. From meetings 1 and 2 in cycle II, there was an increase in student activity by 1,89%.

The recapitulation of the competency test results in cycle 2 can be seen in table 6.

Table 6. Recapitulation of Competency Test Results in Cycle II

Description	Achievements
The lowest value	45
The highest value	100
Average Value	80,48
Students who complete (value ≥ 70)	20
Students who have not completed (value < 70)	3
Completion percentage	86,96 %
Percentage of incomplete	13,04 %

Table 6 shows the range of competency test results in cycle II between 45,00 – 100,00. The average score of students' competency tests in cycle II was 80,48. The average value of chemical competence has fulfilled the KKM (≥ 70). 20 of 23 students (86,96%) scored ≥ 70. Classically completeness of learning in cycle II has been achieved. Based on the classical learning completeness category, the learning completeness in cycle II is in the high category. The average data of the student competency test scores from each group in cycle II can be seen in Figure 3.

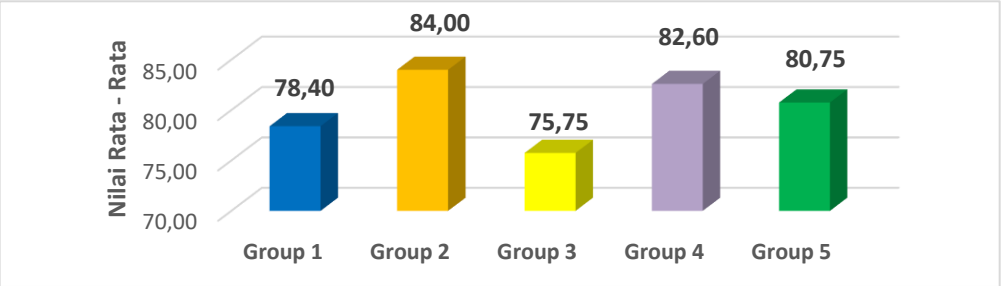

Figure 3. The Average Value of Student Competency Tests for Each Group in Cycle II

Figure 3 shows the average competency score of students in the group between 75,75 – 84,00. The highest average group was obtained by group 2 with an average value of 84.00 and the lowest average was obtained by group 3 with an average value of 75,75. The average value of chemical competence from groups 1, 2, 3, 4, and 5 has reached the specified learning completeness criteria (≥ 70).

Comparison of Cycle I and II

The comparison of student activeness in learning activities in cycle I and cycle II can be seen in Figure 4.

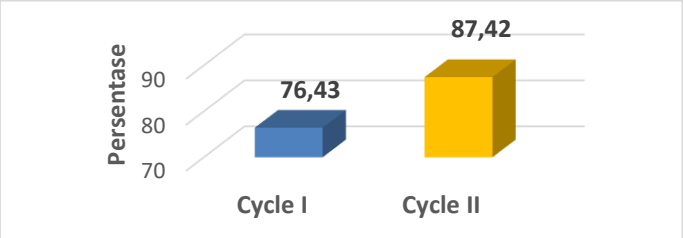

Figure 4. Comparison of Student Activity in Cycle I and Cycle II

Figure 4 shows the percentage of student activity in the first cycle of 76,43% with the category of student activeness including moderate. The percentage of student activeness in cycle II was 87,42% with the category of student activeness including high. From cycle I to cycle II there was an increase in student activity by 10,99%. Based on the student activity data in cycles I and II, it can be concluded that the combination of the application of the Problem Based Learning (PBL) and Team Assisted Individualization (TAI) learning model can increase student activity. The results of this study are in line with the research of Harifi, et al. (2020) which concluded that there was an increase in student positive activity from cycle I by 61%, cycle II by 76%, and cycle III by 84%.

Comparison graphs of student competencies in pre-cycle, cycle I and II can be seen in Figure 5.

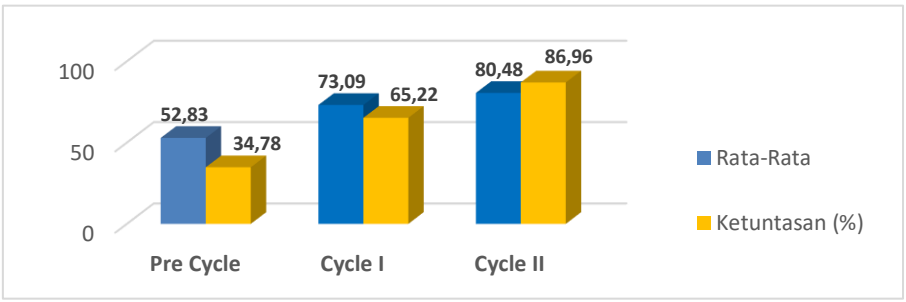

Figure 5. Student Competencies in Pre Cycle, Cycle I and Cycle II

Figure 5 shows the average value of chemical competence in cycle II which is higher than cycle I and pre-cycle. The average value of chemical competence in the pre-cycle was 52,83, in the first cycle was 73,09 and in the second cycle was 80,48. There was an increase in chemical competence by 20,26 from pre-cycle to cycle I and an increase of 7,39 from cycle I to cycle II. The increase in chemical competence from pre-cycle to cycle II amounted to 27,65. The average value of chemical competence in cycles I and II was ≥ KKM. Based on the data on the average value of chemical competence in cycles I and II, it can be concluded that the application of a combination of Problem Based Learning (PBL) and Team Assisted Individualization (TAI) learning models can improve students' competency mastery. The results of this study are in line with research conducted by Anisah, et al. (2018) and Harifi, et al. (2020). Increased mathematical critical thinking skills (Sulistyani, 2012) and metacognitive skills (Shofyan, et al. 2020) also occur in the application of a combination of PBL and TAI learning models.

The percentage of classical learning completeness, in the pre-cycle, was 34,78%, the first cycle was 65,22% and the second cycle was 86,96%. Classical mastery of learning in pre-cycle and the first cycle has not been achieved. Completeness of learning in cycle II classically has been achieved. The increase in classical learning completeness

from cycle 1 to cycle II was 21,74%. Based on the data on the percentage of classical learning completeness in the pre-cycle, cycle I, and II, it can be concluded that the application of a combination of Problem Based Learning (PBL) and Team Assisted Individualization (TAI) learning models can increase the percentage of classical learning completeness. The results of this study are in line with the research of Anisah, et al. (2018), Harifi, et al. (2020) which concluded that classical learning completeness was achieved through the application of a combination of Problem Based Learning (PBL) and Team Assisted Individualization (TAI).

▪ CONCLUSION

From the results of the research and discussion that has been carried out, it can be concluded that the application of a combination of Problem Based Learning (PBL) and Team Assisted Individualization (TAI) can increase learning activities, mastery of chemical competencies, and classical learning completeness of class XI MAN Sampang students in the 2019/2020 school year on Hydrocarbons competency.

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