ANALYSIS OF CHEMICAL EQUILIBRIUM PROBLEM SOLVING SKILL THROUGH METACOGNITION SELF-ASSESSMENT

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Abstract: This research aims to describe declarative, procedural and conditional knowledge in chemical equilibrium problem solving. This research subject was 31 students of XI grade of IBC SMA Kristen Immanuel Pontianak. It was a descriptive research by case study analysis. Instruments which used were metacognition self-assessment and chemical equilibrium problem solving questions. This research result consist of declarative, procedural and conditional knowledge. Aspects of declarative knowledge each for motivation, anxiety control, identification, comprehension belief, target determination, information organizing, thinking strategy and strategy organizing were 90,32%; 29,03%; 12,90%; 29,03%; 35,48%; 58,06%; 77,42% and 25,81%. Aspects of procedural knowledge each for assumption determination, strategy development, chemical equation consideration, chemical equilibrium analyzing, other knowledge using, quantitative analyzing and alternative thinking were 54,84%; 22,58%; 58,07%; 61,29%; 29,03%; 38,71% dan 25,81%. Aspects of conditional knowledge each for progression examination, assumption examination, method examination, time management and solving belief were 25,81%; 32,26%; 25,81%; 22,58% dan 93,55%.

Keywords: *problem solving, metacognition self-assessment*

Abstrak: Penelitian ini bertujuan untuk mendeskripsikan pengetahuan deklaratif, prosedural dan kondisional dalam pemecahan masalah kesetimbangan kimia. Subjek penelitian ini adalah 31 siswa kelas XI IBC SMA Kristen Immanuel Pontianak. Bentuk penelitian ini adalah deskriptif dengan analisis studi kasus. Instrumen yang digunakan adalah *self-assessment* metakognisi dan soal pemecahan masalah kesetimbangan kimia. Aspek pengetahuan deklaratif untuk indikator motivasi, kontrol kecemasan, pengidentifikasian masalah, keyakinan pemahaman definisi dan deskripsi soal, penentuan target, pengaturan informasi, memikirkan strategi dan mengorganisasikan strategi berpikir masing-masing 90,32%; 29,03%; 12,90%; 29,03%; 35,48%; 58,06%; 77,42% dan 25,81%. Aspek pengetahuan prosedural untuk indikator penentuan asumsi, pengembangan strategi, pertimbangan persamaan kimia, menganalisis faktor kesetimbangan kimia, menghubungkan dengan pengetahuan lain, menganalisis pengetahuan kuantitatif dan kemampuan menemukan cara berbeda masing-masing 54,84%; 22,58%; 58,07%; 61,29%; 29,03%;

38,71% dan 25,81%. Aspek pengetahuan kondisional untuk indikator pemeriksaan kemajuan penyelesaiaan soal, pemeriksaan asumsi, pemeriksaan metode, pengaturan waktu dan keyakinan pada penyelesaian soal masing-masing 25,81%; 32,26%; 25,81%; 22,58% dan 93,55%.

Kata kunci: *pemecahan masalah, self-assessment metakognisi*

Metacognition is thinking about thinking (Downing, 2009; Dawson, 2008) or cognition about cognition (Tosun, 2013). Dawson (2008) viewed "metacognition skills are usually conceptualized as an interrelated set of competencies for learning and thinking, and include many of the skills required for active learning, critical thinking, reflective judgment, problem solving, and decision-making". So, metacognition is knowledge, skill and awareness about strategy, process, control and regulation of one's higher order thinking.

Hacker (in Downing, 2009) divided metacognition into 3 types of thinking: metacognitive knowledge (what one know about knowledge), metacognitive skill (what one do this time) and metacognitive experience (cognitive condition or one's behavior this time). Rompayom, Tambunchong, Wongyounol and Dechsri (2010) categorized and defined metacognition knowledge into declarative knowledge (knowledge that student has information or needed source to carry on the training given, such as knowledge about aim, demand and task characteristic), procedural knowledge (knowledge about oneself to his/her capacity how to do something) and conditional knowledge (knowledge about when and why use strategy to solve problem, knowledge in situation which student uses his/her kowledge about special lesson, algorithm, technique and method).

Favieri (2013) explained dimension of declarative metacognition knowledge into intellectual knowledge on strength and weakness, motivaton knowledge, anxiety level knowledge, knowledge of organization skills of information and learning control knowledge, dimension of procedural metacognition knowledge into different ways of studying knowledge, use of the different ways of studying, resources for knowledge localization, study material organization and classmates studying in group while dimension of conditional metacognition knowledge into confidence in own capacities, adapting the way of studying to the situation, self-motivation, level of anxiety control and using strengths to compensate weakness.

Problem solving could be defined as the process of making something into what you want it to be (VanGundy, 2005). PISA (2010) defined problem solving competency is an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. So, problem solving skill is the capacity of individu in process and strategy of thinking through using knowledge and experience of individu in new situation and challenge.

Facione (in Snyder, 2008) formulated 6 steps to think effective and solve problem that abbreviated IDEALS: I – identify the problem: what is the real question we are facing?; D – define the context: what are the facts that frame this problem?; E – enumerate the choices: what are plausible options?; A – analyze

options: what is the best course of action?; L – list reasons explicitly: why is this the best course of action?; S – Self-corret: look at again what did we miss? Problem solving skill contains 4 knowledge contents: declarative, procedural, conditional and strategy. Three of first contents is as same as with metacognition knowledge component (Solaz-Portales & Lopez, 2007). Because of relation between problem solving skill and metacognition, so it is important to be investigated problem solving skill in metacognition knowledge side. According to Tro (2014), the main mistake for student when try to solve chemical problem is they do not know the point to begin.

Research of Nicol dan MacFarlanen (in Dawson, 2008) found that formative assessment roled to find student metacognition. This formative assessment could be self-assessment (Spiller, 2012), Self- assessment occur when student evaluate and make judgement about his/her own job (Wesson, 2013). Self-assessment is student centered, so it is very appropriate to expose student metacognition knowldege and could be used in application of 2013 Indonesia Curriculum. According to Petty (in White, 2010), the most important benefit of self-assessment is make student conscious thath success or failed do not depend on talent, lucky or skill, but based on training, effort and correct strategy using, in order to student is motivated and empowered.

Result of Bedford and Legg's research (2007) show that self-assessment prefer to tutor assessment, though self-assessment is felt as didactic values because student learn from problem of his/her self. Self-assessment includes reflection of student's self so that it is categorized as reflective assessment. Reflective assessment is a form of metacognition (Bond, Evans, & Ellis, 2011). From description about self-assessment before and its relation to metacognition so could be made an instrument called self-assessment metacognition.

Preliminary investigation of metacognition strategic of student XI grade of Immanuel Bilingual Class SMA Kristen Immanuel (IBC SKI) Pontianak through question possing adapted and modified from Kaberman dan Dori (2008), found that from 92 respondents 71,74% students could make high complexity question, 45,16% students are able to think on application till analysis, 45,16% students could use least three of four chemical comprehension level (macroscopic, symbolic, microscopic and process), and 32,26% students have high intermediet metacognition strategic. Metacognition strategic shows the one's ability to monitor and improve his/her progress in evaluate the comprehension and application of knowledge in new situation (Flavel in Kaberman & Dori, 2008). Data from chemistry teacher of grade XI IBC SKI Pontianak shows that KD-4 about chemical equilibrium is the highest in class average. According to interview with chemistry teacher of grade XI IBC SKI Pontianak about chemistry learning in class, found that students had ever been given guided problem solving exercise refer to International General Certificate of Secondary Education (IGCSE) standard of Cambridge University. One of claims of chemistry skill as written as in KI-4 2013 Indonesian Curriculum in Chemistry subject for XI SMA is self-employed to process, logic and present data. Therefore is elected problem solving question to see students' self-employed in implement the strategy of problem solving.

According to the theories and facts found, need to be held a research about metacognitive knowledge in chemical equilibrium problem solving in XI IBC students of SKI Pontianak. Metacognition self-assessment is expected could be expose problem solving skill from point of view of metacognition knowledge of XI IBC students of SKI Pontianak.

METHOD

Research method used was descriptive method and it was analyzed by case study method. Research subject was 31 students of XI-D program IBC SKI Pontianak in academic year 2014/2015 (superior class with medium language in English). Research technique done was direct observation and semi-structured interview. Direct observation done was helped by indirect communication technique use metacognition self-assessment questionnaire.

RESULT AND DISCUSSION

Chemical Equilibrium Problem Solving Skill

Results of the student's answer to any problem that was done could be seen in Figure 1. Question 1 about the dissociation of peroxide, the question 2 about the manufacture of ceramics and question 3 concerning the bread production. Of these three questions given, there was no successful student obtain categories A and B. For problem 1, as many as 52% student did not answer completely with incorrect workmanship. Generally, student started from reaction equation and difficult put an end to solve problem because of the difficulty of processing the data by a factor of chemical equilibrium involved. For questions 2 and 3 respectively 42% and 52% student did not answer. There was a tendency student did not solve the problem. This was due to the difficulties faced in doing question 1 time-consuming and reduce the motivation of student to tackle the next problem.

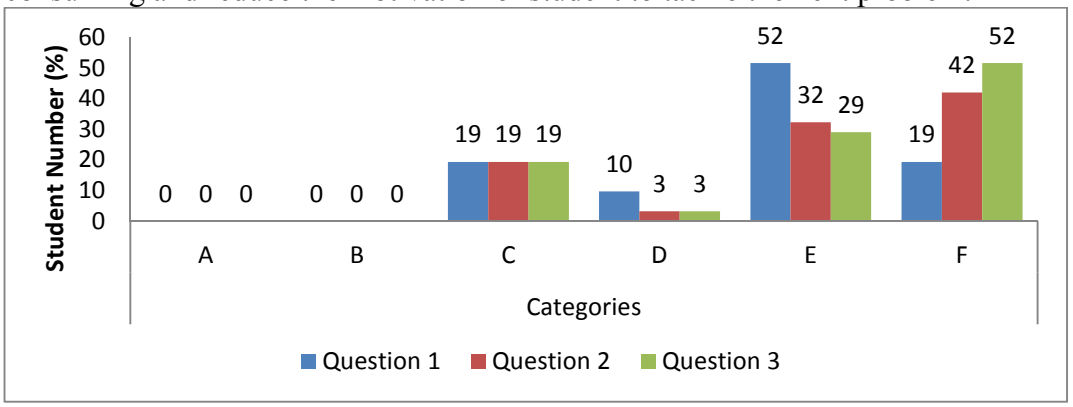


Figure 1: Category of Result of Chemical Equilibrium Problem Solving Skill

Note for Categories:
A = complete answer – correct workmanship
B = completeless answer – coreect workmanship
C = completeless answer – incorrect workmanship
D = incomplete answer – correct workmanship
E = incomplete answer – incorrect workmanship
F = no answer

Student answer sheet could only describe troubleshooting indicators: identify the problem, define the context, enumerate the choice and analyze option. Indicators used in problem solving could be seen from Figure 2. Generally, students of Class XI IBC SKI Pontianak had good motivation to solve the

problem and in both define the context of the problem faced. Based on interviews with Class XI chemistry teacher IBC SKI Ponianak retrieved data that the student's interest in chemistry were very heterogeneous, generally they are only interested in learning-oriented values. In addition, more than 50% of the students have chemistry achievements (cognitive) were about the same, so the atmosphere highly competitive learning and lead to motivation to excel among others were quite large. This was affecting the motivation of students in solving problems. As usual to complete a problem, they were good enough in determining the condition of a problem given.

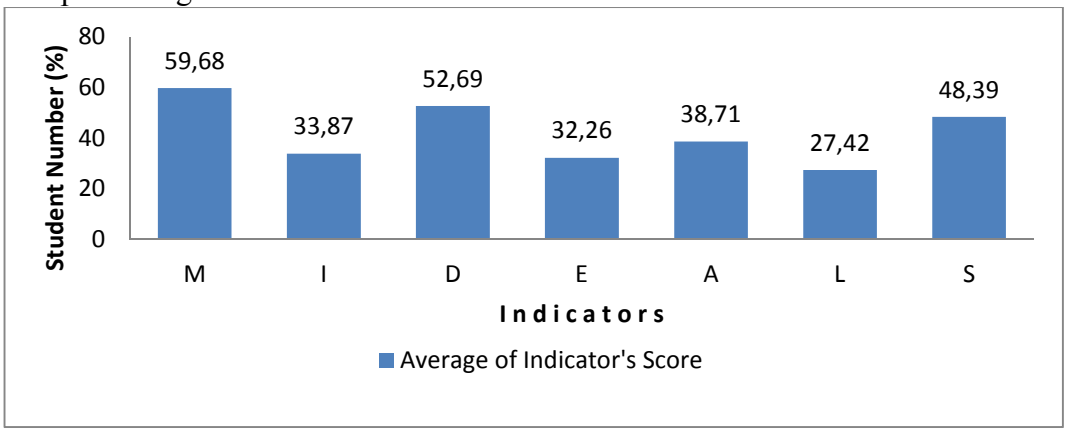


Figure 2 Student Number Persentage in Chemical Equilibrium Problem Solving Indicators

Note: M= motivation; I= identify the problem; D= define the context; E = enumerate the choice; A= analyze options; L = list reason explicitly; S = self-correct

Declarative Knowledge in Chemical Equilibrium Problem Solving Skill

Result of declarative knowledge in chemical equilibrium problem solving skill of student could be seen in Figure 3.

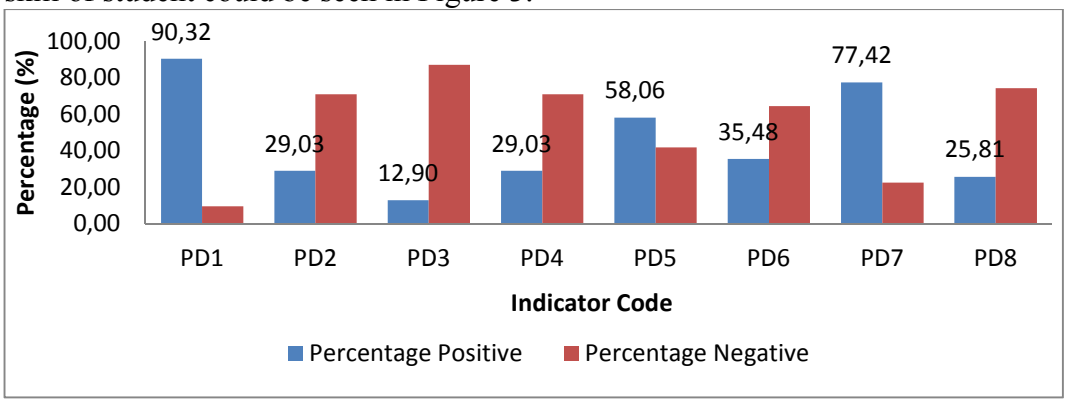


Figure 3: Percentage of Student Declarative Knowledge

Note:

Code	Indicator	Code	Indicator
PD1	Motivation to solve problem	PD5	Identify important information
PD2	Anxiety control	PD6	Target determination
PD3	Identify similar problem model	PD7	Think the possible strategy
PD4	Belief in comprehension of problem	PD8	Know how organize the strategy

Based on Figure 3, declarative knowledge of students of Class XI IBC SKI Pontianak had the highest score on indicators of self motivation (PD1) 90,32% and the lowest score and introduction of indicators on issues (PD3) 12.90%. In general, the students had good motivation, information organizing and possing the problem solving strategies. Every indicators in declarative knowledge relate each other so high or low of the indicator's score will affect other indicator. Considered from intrinsic motivation, students wanted to solve problem because curious, challenge and will schools one's self. Considered from extrinsic motivation, students perforced to solve problem because there was an issue that test result will be taken up and student perforced to help this research.

According to interview with student retrieved that 50% students had an interest to chemistry. They believed that chemistry was absorbed, interesting and appealing. Based on teacher opinion, students' perseption in chemistry were so heterogenous where most of students only interest to chemistry as a lesson not chemistry as a discipline. This was relevant with Lai (2011b) that belief, perception, assessment, interesting and affective will constalate form motivation. Considered from learning style of student, according to interview of students exposed that 42,86% students had independent learning style. Independent learning style is learning way which one prefers learn alone because (s)he belief in his/her ability (Uzuntiryaki, 2007). Self-belief level in learning style organisation affected to one's motivation to solve problem. Learning style was related to student's affective in learning. Accroding to interview with student retrieved that 50% students prefered work alone than in teamwork. This was because in general they thought that will be moe effective to solve problem alone.

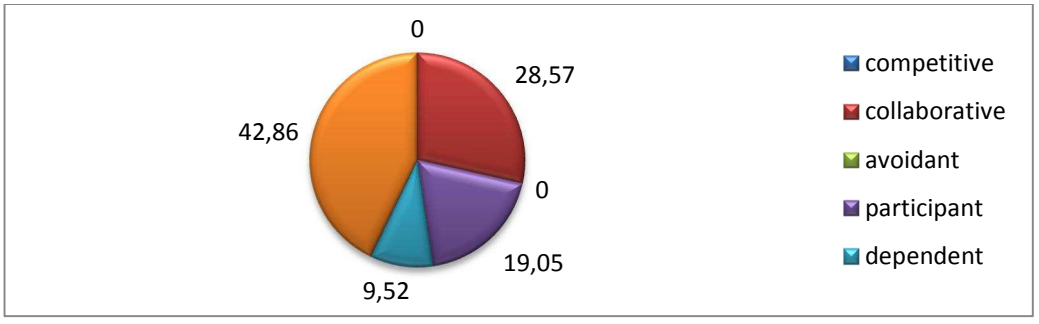


Figure 4: Student Learning Style of XI IBC SMA Kristen Immanuel Pontianak

The reason of interest, learning style and self-belief trigger students' motivation to solve chemical equilibrium problem. All of fact and data collected showed that students' management of self-motivation was so good. According to Martinez (in Lai, 2011a), management of motivation, affective and metacognition strategic is needed in metacognition. Therefore, metacognition in declarative knowledge of XI grade student of SMA Kristen Immanuel (IBC) Pontianak to solve problem was so good.

Deviation standard of students' age was 0,49, it means that the different age of student could be neglected, about 16 year old. In 16 year old, one in middle adolescence phase. In this phase, teenage admits only like to certain topic, subjective, could not sure to decide and belief that every opinion is same (Lai,

2011b). By that determination, teenage tends to worried in decide something and difficult to control the anxiety. In this case, student of XI IBC SMA Kristen Immanuel Pontianak showed self-unsuccessness in anxiety control.

Consequence of self-unsuccessness in anxiety control was making students not able to know or identify the probel with the knowledge thay have. It seemed in students' answer in indicator PD3, that only 12,90% who could know the similarity of problem concept given with chemical equilibrium knowledge they had. Based on students' questionnare reasons retrieved that forgot factor is one of reason that made students had a difficult in problem identification. Effect of unability and the forgot factor will cause anxious and impact to strategy control in information finding (Miller, Guerin & Wolford, 2011). According to interview result with students, as many as 60% student had additional learning out from school. The number of students could not know the problem, show there was not effect of additional learning in student declarative knowledge.

In addition, consequence of unable to control the anxiety was self-unbelieved to comprehension of question. As many as 70,97% students did not belief that they understood the question with various reasons. On question 1, there were some misconception like ignoring the role of catalyze in dissociation peroxide reaction, belief that effective term was how time fold, molar volume of oxygen gas has changed or same with room volume, dissociation reaction make reference to dissociation degree and dissociation was exothermic reaction.

At question 2 there are some mistakes that looked at the meaning of x in formula hydrates Kaolin.xH2O compound was atom that must be replaced with a metal or the number of moles of hydrates, looking Δ emblem of the combustion reaction of clay as a condition that must be replaced by adding a catalyst, the furnace volume is equal to volume of water vapor, in other words, the volume of gas in the furnace remains the same even if included solids, and the partial pressure of the gas is equal to the volume of gas. At question 3 there were some mistakes that gluten wass a separate substance from wheat flour and yeast was a fungus.

Although the students were so low in anxiety control, but influence of motivation of students to the completion of this chemical equilibrium problem making students made any effort to resolve the matter. Results from PD5 indicator, showed 58.06%, students wrote down important information of a given problem. Based on the interviews found that 30% of students ware more interested in the form of numbers data, 30% more interested in the chemical equation, 15% more interested in the compounds involved and 25% prefer to understand about the whole first and write down important information. Many students were more interested in the data and the difficulty of understanding the symbolic matter, making it difficult to determine the important information from problem. Point of view the meaning of important information that affects the targeting of problem solving as contained in the indicator PD6.

Target of question 1 was finding the things that cause increased peroxide dissociation reaction products. Target of question 2 was finding the things that cause water vapor from combustion reaction clay much regardless. Target of question 3 was finding the things that cause a lot of bread formed quickly where

the structure and taste are good. Based on the solving of question what was done, had found students had a mistake in determination the target of question 1, 2 and 3 respectively as much as 80.64%, 87.10% and 83.87%. Fallacy determine these targets affected the assumptions that were made to resolve the problem. Results indicator PP1 about making assumptions is 45.16% student did not make the assumption because they did not know what to make any assumptions. The assumption will be made adjustable with strategy of problem solving thought.

The results of PD7 indicator showed 77.42% student could think of strategies to solve the problem. The number of student who thought of many ways as possible till the decision to use the strategy chosen was influenced by the thinking of students to chemistry. Results of interviews with students obtained the data as much as 45% student felt they were not so good at chemistry calculations and 55% student feel incompetent in chemical concepts. Effect of error and confusion in determining the matter of vital information make students hard thinking about making strategy with respect to stoichiometric or linked to the chemical concept. Therefore, students will have difficulty determining the strategies and methods used to solve problems. Misalignment of data seen from the results of PD8 indicator which 74.19% students do not know how to organize a strategy that thought. Most of students do not know how to start a work matter. This was relevant to the opinion of Tro (2014) which states that determine where to start as the main difficulty for students in solving chemical problems.

Procedural Knowledge in Chemical Equilibrium Problem Solving

Figure 5 showed the percentage of each indicator procedural knowledge. The PP1 indicator results showed 54.84% of student made assumptions to solve problems. In general, the students realized that the assumptions necessary in solving problems.

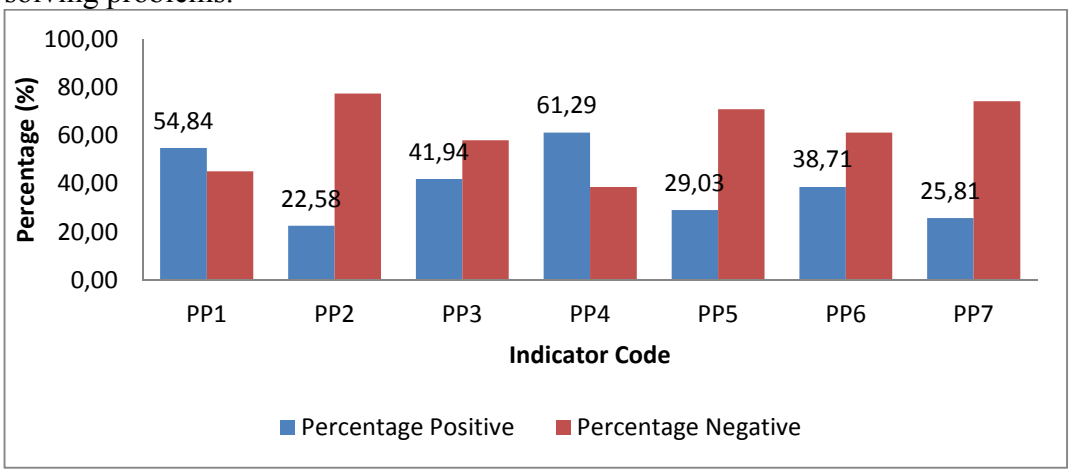


Figure 5: Percentage of Student Procedural Knowledge

Note:

CODE	INDICATOR	CODE	INDICATOR
PP1	Assumption determination	PP5	Use othe knowledge to solve problem
PP2	Develope the plan from the strategy chosen in to subs of problem	PP6	Analyze quanitative aspect
PP3	Making chemical equation	PP7	Think any possible ways that could be done to solve problem
PP4	Analyze the factors engage in chemical equation		

Based on interviews with the student found that 75% considered assumptions are considered predictive of a problem but not necessarily correct, 5% considered assumption as implement something that is known at something you want to be found, 10% considered the assumptions as what is asked and how early thinking to solve matter, 10% could not express his opinion on the assumptions. Students' understanding of these assumptions, combined with his understanding of the problem given made 12,90% student considered assumption was not necessary to resolve this problem while 19,35% students did not know to make assumptions as to what.

Based on interviews with students found that in addition to the school, as much as 25% students had a busy in student's organizations and 25% students busy in helping parents' businesses. The busyness trained students' independence and pattern / strategy of student thinking. There are 35% of the student who made the assumption spent the rest time with the organization and help need parents. It showed the influence of autonomy in one's knowledge procedural metacognition.

PP2 indicator results showed that 77.42% student could not develop a problem-solving plan. The magnitude of the students difficulties in developing problem-solving plan will have a big impact on the problem-solving procedure of the student. Based on interviews with teachers, student generally rarely wrote about chemistry working procedures to answer them in detail. They usually wrote what became the main point of problem solving. Mechanical work procedures performed in the students answer the questions varied. According to teachers, students prefered and maintained work procedures taught by teachers or tutors of them.

Students began to work out the question 1 of the chemical equation. The PP3 indicator results showed 41.94% of student using the equation for the reason that more easily work on the problems, familiar, and the rest as there were on the matter and that no tossing and turning the paper. However, there were 16.13% of students who used chemical equations without writing it, so there were 58.07% students who considered the chemical equation for starters problem solving. In view of the student, preparing chemical equation was to integrate the data in ICE scheme (initial-chemical-equilibrium) or limiting reagent scheme. Therefore, students who struggled to develop problem-solving strategies exist that avoid the use of chemical equations. But there also were confused what to use it for. This was also consistent with the results of student interviews that 30% of student always focus on chemical equations to solve problems of chemistry. Student who answered question 1 start of a chemical equation peroxide dissociation reaction. Starting from this chemical equation, there were seven main strategies used by students in answering how effective peroxide dissociation reaction, they were reviewing the degree of dissociation (3.22%), reviewing the radical reactions (9.68%), reviewing price equilibrium constant concentration / Kc (6.45%), reviewing price equilibrium constant partial pressure / Kp (3.22%), reviewing the concept of moles of existing data (3.22%), reviewing the ICE scheme or limiting reagent (41.93%) and reviewing factors determining the chemical equilibrium shift (45.16%). There were several student who combined strategic thinking because they were basically a lot of thinking about how to solve this problem.

Not find a solution in a way, then they try the other way. Generally they could not provide specific ways offered to strengthen their answers. For example, did not give way how to change the pressure, volume, and the concentration.

There were 3 reference work of question 2, those were 6.45% students started of nominal data of question, 6.45% students startede with a data base of ceramic materials, and 54.84% students started of chemical equation of clay combustion reaction. Reference to the nominal data that student used to sketch the problem and without analyzing the data could be concluded that need increased concentration, temperature and pressure. Reference to the data base on ceramic material that used student to control the process of making ceramics, treatment given and the basis for the chemical equation. Reference chemical equation of clay combustion reaction used in 5 variations of student thinking patterns, they are replace the component substances (5.88%), using the ideal gas equation (23.53%), the use of ICE scheme (23.53%), a sketch of the problem (5,88%) and reviewing factors shift the chemical equilibrium (70.59%). In question 2, students solved problems by rote because students were still not able to determine the equilibrium factor based on the facts. There are 70.59% using the student's lack of information or data about so wrong solved the problem. In general, the student was more difficult to solve question 2 with no as varriative as strategy in question 1 because fewer were solving problems. This way of thinking student in question 2 was not much that use more than one strategy. This was because the student was more difficult to understand the problem and design a problem-solving strategy.

There were 2 references in the student started up question 3, those were of the data material and recipes as well as fermentation reactions. Reference materials and recipes from the data used for students to change the process of making bread kneading stage and development stage. The concept of thinking with reference was the logic using of students of the use of each ingredient used. The mistake that happens was that students did not understand the gluten in the flour. Consequently student erred in concluding way chosen. Reference fermentation reactions student selected by 51.16% since this was the most salient information from matter. The amount of information that was given from the question and the criteria desired bread used as a basis for further thinking strategy. There are 3.22% student could not apply the idea of solving the problem after reviewing the criteria desired bread. Generally student thinking bread desired criteria were separate. This triggers confusion and difficulty in filing the proper way. There are 12.09% of student considering bread baking time needs to be changed. They think that time is inversely proportional to the rate of the reaction so that the time had no role in the process of making bread. Extend the roasting time, combined with a decrease in temperature by student will produce good bread structure. There are 62.5% of the student to analyze the factors that influence the reaction equilibrium shifts. Of this group, 10% student answered influence room pressure should be lowered so that products will increase. As many as 20% of student considering roasting temperature, which should be considered is the temperature of fermentation. Still in the same group 90% of the students review the effect of concentration where many student thinking to add

sugar to the reaction shifts to the right. The rest of the student review the concentration of yeast, gluten, flour, salt, water, shortening and milk. Yeast in this case is the catalyst in the reaction of sugar fermentation, so the addition of the catalyst will only increase the rate to the right. Gluten is a protein in the flour so it could not be separated so that the addition of gluten is a mistake. However, the addition of a high-protein flour is acceptable because it means the level of gluten reproduced. The addition of water, salt, shortening and milk basically aims to control fermentation and working gluten hold CO_2 gas produced. Separate thought this showed the students have not been able to analyze more in all likelihood could be done to make bread with the requested criteria.

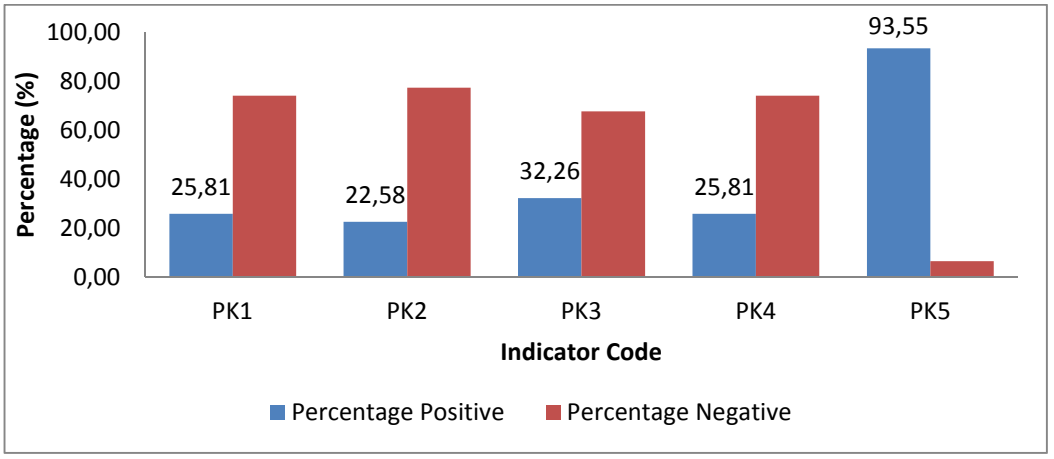
Based on the students' thinking scheme on question 1, question 2 and question 3 found that many student start workmanship of the chemical equation. Based on interviews with students found that 30% of students started up chemistry problem of nominal data given, 30% student of chemical equations, 15% saw a compound that reacts and 25% student understand the questions given in advance. Based on interviews with chemistry teacher in class XI IBC found that students tend to like the equation when it wants to end the known data is nominal and more lead to the ICE scheme.

Based on the strategies used in the solving of question 1, 2 and 3 has the largest percentage of student reviewing chemical equilibrium factor. Based on the working procedures of the student in question 1, 2 and 3 show the error occurred at chemical equilibrium factors. Research conducted Adaminata and Marsih (2011) found an error in the material concept of chemical equilibrium in Indonesian high school students to the chemical equilibrium shift factor is 82% on the effect of changes in concentration, 59% on the effects of changes in temperature and 69% on the influence of the catalyst. Misconceptions at this concentration effect occured because most students assumed equilibrium will occur when the concentration of reactants and products alike, as well as the difficulty in understanding the effectiveness of the reaction to the given conditions.

Conditional Knowledge in Chemical Equilibrium Problem Solving

Based on Figure 6 data showed that student were not enough to check the progress of the settlement, less management time, did not check the accuracy of the use of assumptions and methods used to check on problem solving conducted. However, the level of confidence in the accuracy of problem solving was done quite high.

Results of PK1 indicator found that 74.19% student did not check the progress of the settlement / solving problem because it could not do, be sure it was definitely wrong, believed the answer the first time, and there was no time. There were already checked, but no closer to an answer. Based on interviews with teachers, students generally did not check workmanship matter because not enough time and sure vain check the answer because it knowed for sure wrong.



Gambar 6 Percentage of Student's Conditional Knowledge

Note:

CODE	INDICATOR	CODE	INDICATOR
PK1	Check the progress of problem solving	PK4	Check the method used has been correct
PK2	Effective time management	PK5	Have belief in problem solving that has done
PK3	Determine the assumption chosen has been correct		

Results PK2 indicator showed students were poor in working on the set time given. Many of them were difficult to focus on something that was believed not to be done, not to mention the notion of question that did not draw cause drowsiness and dizziness. By the time they did not understand to think about what to think and did not know what they wanted to write just a dreamy look about.

The results PK3 indicator obtained that as many as 67.74% student did not examine the assumptions that had been made it wass right or not. The reason was they were not sure of the assumptions that had been made, because they did not understand the problem and there was no assumption of the initial construct. This was the impact of the student's inability to control the anxiety that lead to pessimism in workmanship matter. In addition, students' thinking strategies which only focused on knowledge of chemical equilibrium made them difficult to think of what it actually wanted to be found. PK4 indicator results showed as much as 74.19% students did not check back stage about the work they did. They did not check because did not know, did not finish work on the problems, there was no time and realized that the answer was not the right way. But there was student thought did not need to check about the stages of processing carried out because he felt the outcome was consistent with the answers he wanted and if nothing was calculated.

Results PK5 indicator showed the level of confidence in the results of the student's own work was very high. There are 93.55% of students were not feeling to need to prove the answer to the cooperative way. Based on the results PK5 indicator, the level of students' beliefs was comparable with cognitive achievement of students. Student who was so sure of the answer had good chemistry learning achievement. This was according to research Coutinho (2007) was their mastery of learning objectives (goal mastery). Based on interviews with students and teachers, generally oriented student-centered learning outcomes without an interest in chemistry. The students' attitudes educated themselves to increase their confidence.

CONCLUSION AND SUGGESTION

Conclusion

Declarative knowledge of students on the motivation was 90.32% and 29.03% for anxiety control. Identify the problem of the initial knowledge of the students was 12.90%, belief in the definition and description of the problem given was 29.03% and targeting issues was 35.48%. The organizing of the information of about 58.06%. There were 77.42% of the students could think of strategies that might be used to solve the problem but only 25.81% of students were able to organize their thinking strategies. Procedural knowledge in determining the assumption was 54.84%, There were 22.58% of students capabled to develop a strategy plan completion. There were 58.07% of the students started up about 61.29% equation and analyzed the factors involved in shifting the equilibrium in which misconceptions were found at most the effect of the concentration. Only 29.03% of students who tried to resolve the problem by connecting other knowledge. There were 38.71% of the students analyzed the quantitative aspects and 25.81% of students were able to find other ways which could be used to solve the problem after problem processing time expires. Conditional knowledge in determining the time and reason for the using of strategies by examining the progress of problem solving was 25.81%, examination of the assumptions made was 32.26%, the examination methods used was 25.81%, 22.58% of the time management and belief on the work itself was 93.55%.

Suggestion

Observations need to be made early metacognition skills in addition to asking questions such as the skills to make a map of concepts and create self-description. Research needs to be done regarding awareness metacognition metacognition and knowledge to see the full metacognition in class XI IBC SKI Pontianak. Research needs to be done in respect of students' metacognitive knowledge of class XI IBC SKI Pontianak on the reaction rate material, and acid-base solution for in-depth review of metacognitive knowledge in chemical equilibrium. Schools need to do exercises to improve students' metacognitive knowledge in chemistry as a way of discourse highlight important information (for declarative knowledge), create concept maps (for procedural knowledge) and propose conceptual problems (for conditional knowledge).

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