ANALYSIS SCIENCE PROCCES SKILL OF PROSPECTIVE CHEMISTRY TEACHER (CASE STUDY IN THE CITY OF SEMARANG)

Nur Faridatus So'imah[1)]
[1]Universitas Muhammadiyah Semarang
email: idaa64679@gmail.com

Abstract

The 21st Century is an era of reform and globalization marked by the emergence of free competition between nations. Competition that occurs involves all nations of the world who are required to have capable abilities / skills. the skills that must be possessed are scientific skills. Science Process Skills are intellectual skills that all scientists use to understand natural phenomena. Science process skills involve cognitive or intellectual, manual and social skills. This research uses quantitative descriptive method. The sample of this study was Chemistry Internship Students Universitas Muhammadiyah Semarang. Data collection techniques were carried out using four instruments, namely: questionnaire, test questions, interview and observation. The purpose of this study was to analyze the extent of the science process skills of chemistry internship students. Analysis of science process skills is divided into seven indicators namely observing skills, grouping skills, skills using tools and materials, interpreting skills, forecasting skills, applying concept skills, and communication skills.

Keywords: *21st century skills, science process skills, internship students.*

1. INTRODUCTION

The 21st century is an era of reform and globalization marked by the emergence of free competition between nations. The competition that occurs involves all nations in the world who are required to have capable abilities / skills, not just academics. This ability is expected to be a provision in the world of work. For this reason, the Indonesian nation needs to build quality human resources through formal and informal education. Based on Law No. 20 of 2003 concerning the National Education System, education in Indonesia is aimed at developing potentials in the nation's children to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed for themselves, society, nation and state.

One of the skills that must be possessed is scientific skills. Based on the 2013 Curriculum used in the Indonesian Education System at this time, strongly emphasizes a scientific approach to every lesson, especially chemistry learning. Chemistry is a science based on experimentation. Skills / skills in this science are needed by students to be able to understand chemical material more realistically. To achieve this goal, we need a teacher who is able to educate properly and correctly. Therefore, it is necessary to increase human resources who are able to make students skilled, supported by teacher competence in the field of practical planning. Increasing human resources can be done early on in chemistry internship students in particular. Chemistry apprentices are required to master science process skills. Science process skills can be trained while participating in learning in the lecture bench.

According to Gagne (in Dahar, 1995) Science Process Skills are intellectual skills that are used by all scientists to understand natural phenomena. Science process skills involve cognitive or intellectual, manual and social skills. Cognitive or intellectual skills are involved because by doing scientific processes students will use their minds. Manual skills are involved in science process skills because they involve the use of tools and materials, measuring, assembling or assembling tools. Meanwhile, social skills describe students' interactions with each other in learning, for example discussing observations.

Everyone's science process skills are different. To find out the ability of Chemistry Apprentice Students in terms of science process skills, analysis is needed by taking data samples. The science process skills possessed by interns are expected to be able to produce a young generation who are strong and have scientific character, and can channel these abilities to their students when they become competent and professional teachers.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Science process skills not only contain psychomotor aspects, but are also able to generate assessments of cognitive and affective aspects. Cognitive aspects include predictive skills, communication skills, the ability to apply concepts, interpret data skills, and hypothesis skills. Psychomotor aspects include observing skills, questioning skills, skills, planning experiments, skills using tools and materials. While the affective

aspect of science process skills is an attitude during the direct learning process which includes accuracy in data collection, seriousness in conducting experiments, cooperation in discussions and experiments, and honesty in data collection.

In this study, the analysis of science process skills used seven indicators. These indicators are: observing skills, grouping skills, skills using tools and materials, interpreting skills, predicting skills, skills applying concepts, and communication skills. According to Dimyati and Mudjiono (2006), the elaboration of seven indicators that support the ability of the scientific process includes the first is observing skills. This skill has two main characteristics, namely qualitative and quantitative. Observing is qualitative if in practice it only uses the senses to obtain information. Meanwhile, observing is quantitative in nature if in practice other than using the senses it also uses other equipment that provides specific and precise information.

The second skill is grouping skills. Classifying skills means the process of sorting various object events based on their specific properties, so that a similar group or group of the object of the event is obtained. the third skill is the skill to communicate. This skill is a skill in conveying and obtaining facts, concepts and principles of science in the form of sound, visual or visual sound, graphs, maps, charts, symbols, diagrams, mathematical equations, as well as written or spoken words. communication used in science. the fourth skill is prediction skill. Forecasting skills can be defined as skills that anticipate or make predictions about everything that will happen in the future, based on predictions on certain patterns or trends, the relationship between facts, concepts and principles of science. The skills that are used are the skills to use tools and materials. This skill can be interpreted as the ability to use tools and materials in the laboratory. the sixth skill is the skill to apply the concept. This skill is as constructing or reconstructing a science based on existing concepts by conducting experiments. Meanwhile, the seventh skill is interpreting skills, which can be interpreted as the ability to examine the elements of research to test hypotheses so that conclusions can be drawn.

3. RESEARCH METHOD

This study aims to analyze science process skills using qualitative descriptive methods. According to Bogdan and Taylor (in Moeloeng, 1996), a qualitative descriptive method is a research process that produces descriptive data in the form of written or spoken words from people and current observed behavior. Qualitative descriptive method is used to describe the quality of science process skills. This research was conducted in the odd semester of the 2019/2020 school year.

The research subjects were Prospective Chemistry Teacher Students in Semarang City with a sample of three Educational Personnel Education Institutions (LPTK) in Semarang City. The sampling technique or subject determination used purposive sampling. According to Sugiyono (2013), purposive sampling is a technique of sampling data sources with certain considerations. The subject's consideration is determined by taking the subject who is considered the most knowledgeable and least

knowledgeable of science process skills. This was done to make it easier for researchers to explore the existing situation regarding the skills possessed by research subjects. The sample educational institutions for education personnel (LPTK) were LPTK A, LPTK B, and LPTK C. Each LPTK has different characteristics from one another. Analysis of science process skills is based on seven indicators. The indicators used include indicators of observing skills (A1), indicators of grouping skills (A2), indicators of skills using tools and materials (A3), indicators of communicating skills (A4), indicators of predicting skills (A5), indicators of skills to apply concepts (A6), and interpretive skills indicators (A7).

The data collection technique was carried out using four instruments, namely: questionnaires, test questions, interviews and observations. According to Esterberg (in Sugiyono, 2013), a questionnaire or questionnaire is a data collection technique that is carried out by giving a set of written questions to respondents to answer. The questionnaire consists of twenty six (26) questions. The response category used in the questionnaire is a Likert scale which includes: strongly disagree (STS), disagree (TS), agree (S), and strongly agree (SS). Filling is done via google form. Each question is adjusted to the indicators of existing science process skills. Each indicator has a different number of questions.

Another data collection technique was using test questions to determine the cognitive level of chemistry teacher candidate students at each LPTK. The test questions consist of seven questions with each question having its own branch of questions. Problem adjusted according to predetermined indicators. Each question is worth ten points. All points are accumulated to determine the science process skills of prospective chemistry teacher students. Assessment of science process skills questions is obtained by calculating the percentage using the following equation:

$$\% \text{ Science process skills} = \frac{\Sigma \text{ science process skills score}}{\Sigma \text{ maximum score}} \text{x } 100\% \text{ .....(1)}$$

To support the validity of the data, direct interviews and observations were conducted. According to Sugiyono (2013), interviewing is a data collection technique that is carried out by means of question and answer to obtain more in-depth information. The interview that was conducted was a structured interview using previously prepared interview guidelines. Interviews were conducted directly with research subjects where more data was needed related to the questionnaire that had been filled in. Subjects that were interviewed in-depth were those with the highest science process skills and the lowest ones. In addition, observations were also made. Observation is a data collection technique that is done by looking for facts about the real world. Observations are made directly to the research subject using the senses. Observation refers to scientific behavior carried out by prospective chemistry teacher students while in the learning process.

4. RESULTS AND RESEARCH DISCUSSION

A. Research Results

Based on questionnaire data and test questions that have been carried out by prospective chemistry teacher students in Semarang City with a sample of three LPTKs, the following results were obtained:

a. Observing skill indicator

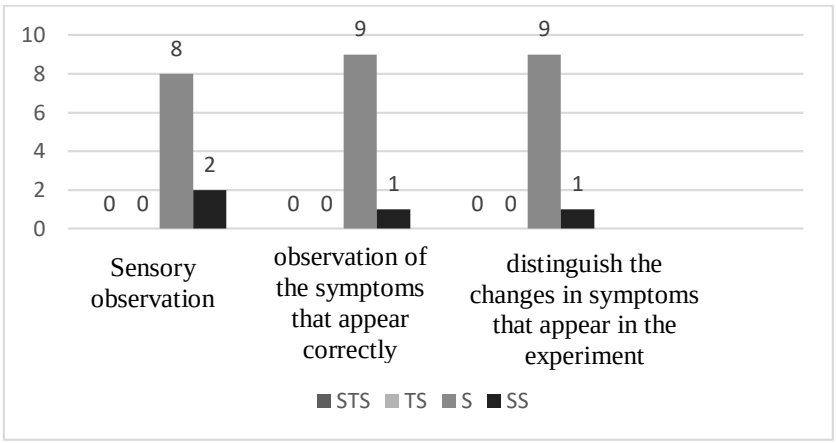

Figure 1. Graph of Observing Skills Indicator Questionnaire Results

b. Indicator of communication skill

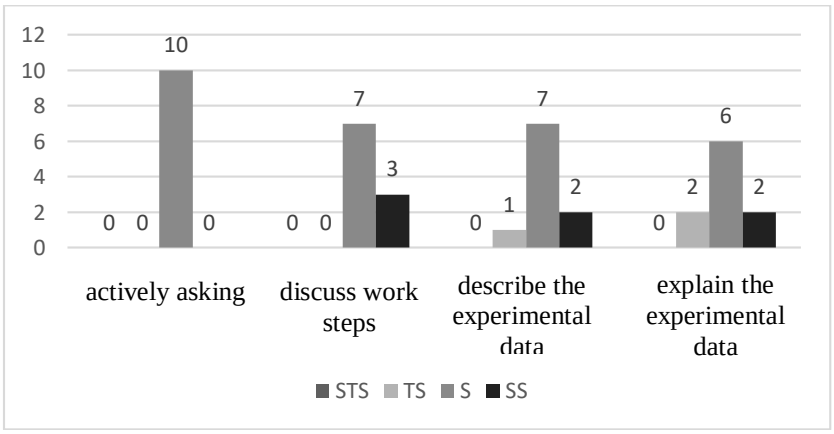

Figure 2. Graph of Questionnaire Results for Indicators of Communicating Skills

c. Indicators of Skills to Apply Concepts

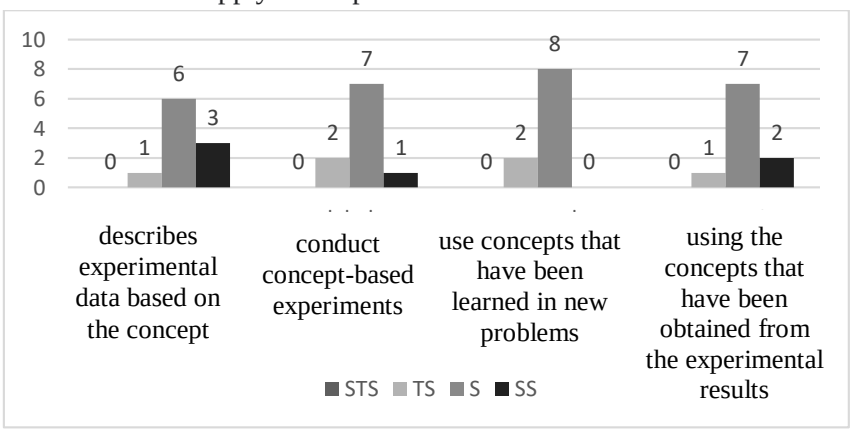

Figure 3. Graph of Questionnaire Results for Indicators of Skills in Applying the concept

d. Indicators of Skills in Using Tools and Materials

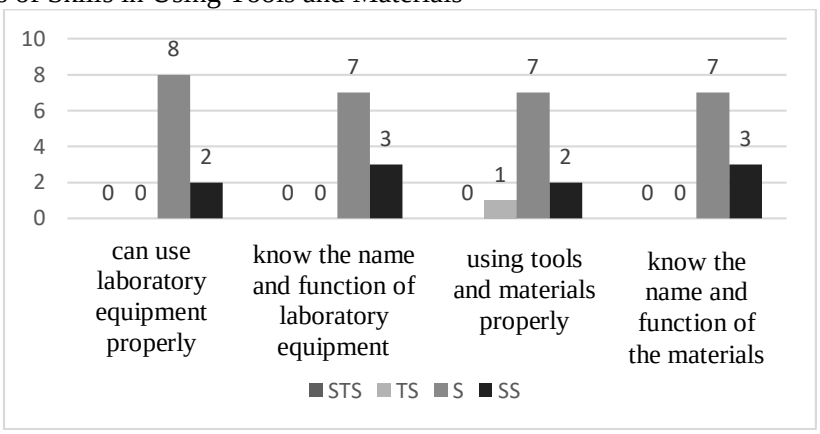

Figure 4. Graph of Questionnaire Results for Indicators of Skills for Using Tools and Materials

e. Predicting Skills Indicators

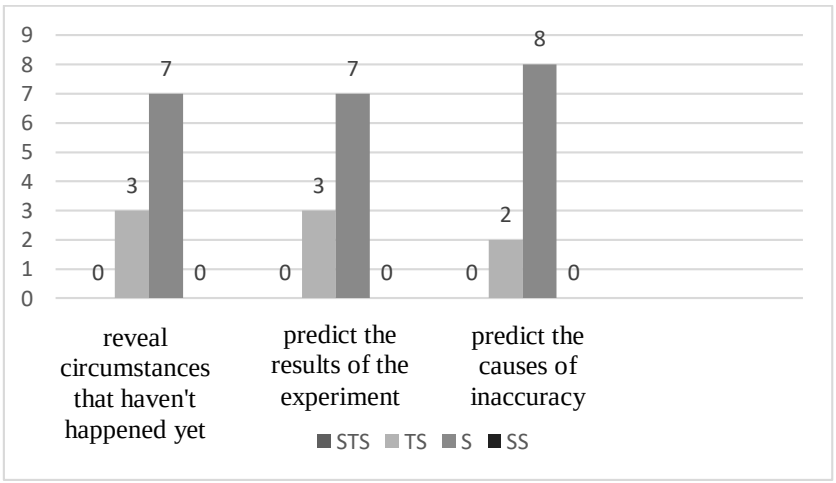

Figure 5. Graph of Predictive Skills Indicator Questionnaire Results

f. Interpretive Skills Indicators

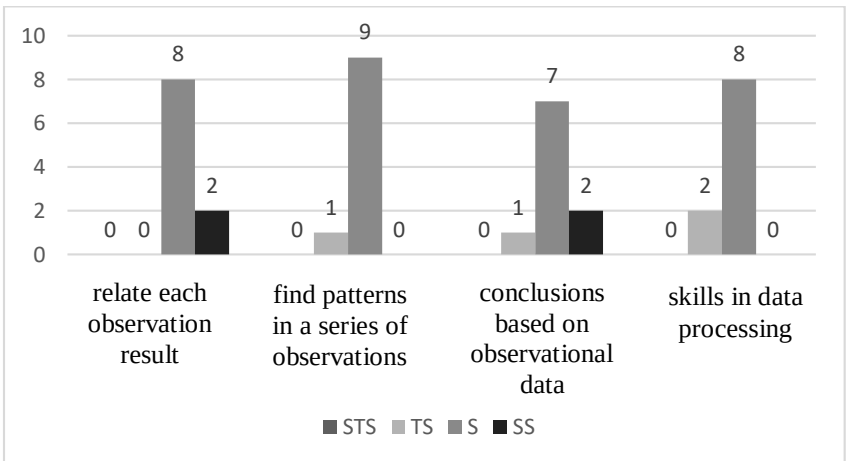

Figure 6. Graph of Interpretive Skills Indicator Questionnaire Results

g. Indicator of Classifying Skills

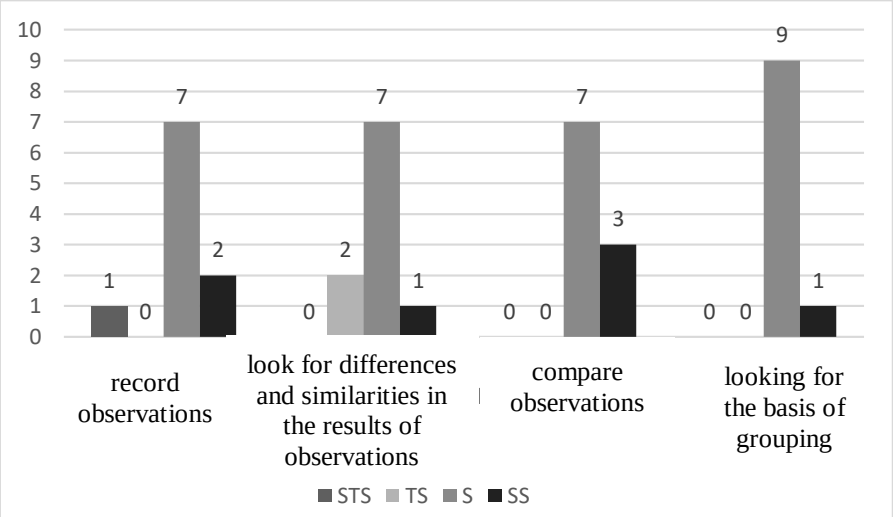

Figure 7. Graph of Grouping Skills Indicator Questionnaire Results

The test questions use a score range of 1-10 for each indicator. The assessment is obtained from the questions done by the respondent. Contains one question for each indicator. The recapitulation of the value of science process skills questions is as follows:

Table 1.Recapitulation of Science Process Skills Problems

SCIENCE PROCESS COMPETENCY INDICATOR

	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**
1.	60	70	80	30	10	70	20
2.	90	80	100	60	50	50	80
3.	100	90	100	50	50	80	80
4.	90	70	100	0	30	80	0
5.	50	60	90	0	30	80	50
6.	90	100	100	50	50	60	80
7.	50	60	90	0	10	60	50
8.	90	80	100	60	70	80	90
9.	80	70	100	70	50	80	70
10.	90	100	80	60	60	70	70
Total	790	780	940	380	410	710	590

B. Discussion

Science process skills of chemistry teacher candidate students in Semarang City with the target of three Educational Personnel Education Institutions (LPTK) play an important role. With science process skills that are owned, it can be a provision which later can be distributed to their respective students when they become teachers. Based on questionnaire data and questions on science process skills, overall it is good and each chemistry teacher candidate is superior in several different indicators. The

superiority of science process skills for prospective chemistry teacher students is shown in the graph below.

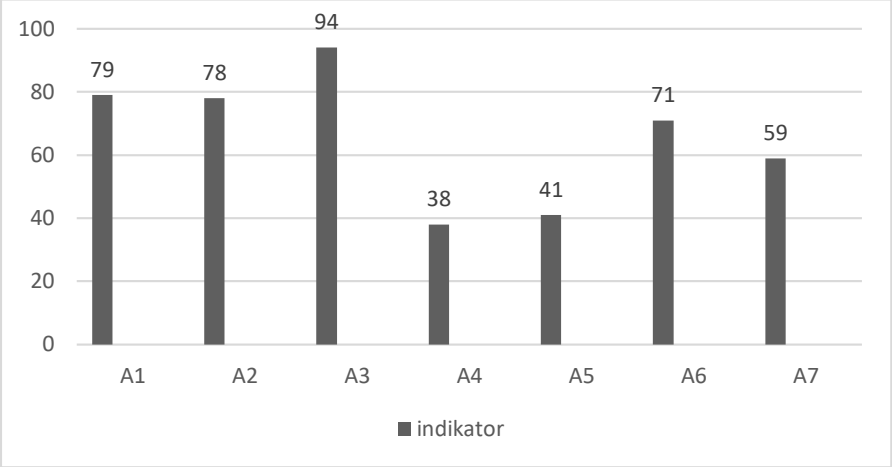

Figure 8. Graph of percentage of results of science process skills

The data shows that the lowest indicator of science process skills in chemistry teacher candidate students is communication skills (A4). While the indicator of science process skills with the highest level is the skills to use tools and materials (A3). Communicating skills include the activeness of asking questions about the material being taught, discussion of work steps or experimental data problems with a group of friends, describing experimental data in oral or written form, and explanations of experimental results obtained during practicum. Communicating skills are more likely to be data processing which involves mathematical cognitive abilities and visual spatial cognitive abilities.

The results of the PISA study published by the OECD (2015) show that the mathematics literacy of Indonesian students at the international level has not been encouraging. Publications released from 2000 to 2015 state that Indonesia's ranking is still at the bottom of the list with an average that is still far from international scores. The results of the PISA show that mathematics achievement in Indonesia is ranked 63rd out of 72 countries. The score obtained was 386. This means that students' competence in mathematical cognitive abilities which include problem solving, critical and creative thinking in general is still low. The low cognitive ability of students in Indonesia is due to several factors. One of the influencing factors is memorizing culture. The paradigm that has developed so far in society, learning is memorizing. This paradigm has grown and cultured from an early age. Students tend to be taught by rote memorization since elementary school.

Memorization culture does not build relationships between stored information. Memorization still colors the learning process at Indonesian Educational Institutions. The explanation of memorization material, without realizing it, has made the nation's children difficult because they are unable to properly digest and understand the material. As a result, students will get used to memorizing rather than understanding concepts or patterns in mathematics. The study conducted by PISA focuses on High

Order Thinking, which includes high-level critical thinking skills. Meanwhile, the facts in the field, education in Indonesia, especially on the questions tested, tend to be Low Order Thinking, namely memorizing, understanding and applying. This is what makes Indonesia rank low on mathematical abilities at the international level.

The low cognitive mathematical ability is in line with the research results obtained based on questionnaire data, test scores and interview results. Mathematical cognitive abilities are included in the sub-skill of communicating which includes data processing, graphs, tables, and others related to mathematical cognitive abilities and visual-spatial cognitive abilities. In this case, there was a mismatch between the questionnaire data and the results of the obtained test questions. Based on the questionnaire that has been filled in, some chemistry teacher candidate students have agreed that they can process data by calculating and pouring it out in graphs. However, it is contrary to the results of the test scores obtained. On the test questions, prospective chemistry teacher students scored low on average. Prospective teacher students tend not to be able to solve problems faced with mathematic.

To support the validity of the data, data collection techniques were carried out with triangulation, namely data validity checking techniques that utilize something other than the data for the purposes of checking or comparing the data obtained. checking the validity of the data was carried out through interviews and observations. Researchers took two samples of research subjects. The research subject used is the subject who gets the highest score and the subject who gets the lowest score. The results of interviews obtained with subjects who received low scores were because since attending school for mathematical matters they were still memorizing formulas. Memorizing these formulas makes research subjects often forget after being taught mathematical material by the teacher. In addition, the low interest in mathematic also affects. The teacher factor also matters. The lack of clarity of teachers in teaching who is driven by memorizing formulas makes research subjects who get low scores confused. As according to the results of direct observations by researchers when learning in class, research subjects who get low scores are indeed lacking in mathematical terms and prefer materials that are racing towards memorization.

The results of interviews with research subjects who received high scores, it was found that the subjects had a liking for chemistry while doing Field Experience Program (PPL). At first he didn't like chemistry. The high science process skills possessed were none other than the provision from campus and while still in high school. In addition, the demand to serve the school while undergoing a Field Experience Program (PPL) increases skills. There is no doubt about laboratory affairs in terms of classification of materials and tools and how to use them. Experience is what makes skills more honed. Based on observations made by researchers when paying attention to subjects in teaching, very interactive in communicating, skilled in laboratory techniques and active in guiding students during practicum. The interest in newly established chemistry made the research subjects who received the highest scores study hard because chemistry was fun.

The skills that have the highest average score are the skills to use tools and materials which include the ability to identify names and functions as well as how to use laboratory tools and materials. Prospective teacher students consider the matter of using tools and materials very easy. That is because before practicum in the laboratory there is a Laboratory Management course that explains what is in the laboratory complete with how to use it. The skills from this campus make research subjects understand and smarter. However, for laboratory equipment that is rarely used and never even understands how to operate it. Based on the results of the interview, the interviewees were afraid of making mistakes that would damage the laboratory equipment.

Based on research on the science process skills of prospective chemistry teachers by FitriaFatichatulHidayah (2015), it shows the existence of science process skills in chemistry teacher candidates who have been able to explore ideas and innovations that exist in each other with inquiry in basic chemistry practicum. This is evidenced by a significant increase in concept mastery ability which includes practical design skills, selecting variables to be used as experimental parameters, formulating hypotheses, predicting experimental results, asking questions, interpreting, and communicating the experimental results obtained. However, this is different from the data obtained by the researcher. Based on research data, communication skills and observation skills are still very low. Mastery of concepts that have not been fully mastered and low cognitive mathematical abilities are the main factors. Therefore, it is necessary to eliminate the culture of memorizing Indonesian students from an early age starting from the teacher as a facilitator for transferring knowledge. In addition, habituation regarding the application of concepts and patterns in working on mathematical problems is very necessary. This will have a positive effect on students and can also increase Indonesia's ranking in the mathematical abilities of the PISA study.

CONCLUSION

Based on the research conducted, supported by data from questionnaires, test questions, interviews and observations, it can be concluded that the science process skills of apprentice students at SMA Negeri 9 Semarang are mostly good. There are only three indicators that have a low percentage, namely the skill indicators to communicate, predict, and interpret tend to be lower with the percentages respectively 38%, 41%, and 59%. The indicators of skills in observing, classifying, using tools and materials, and skills in applying the concepts are mostly good, which is shown by the respective percentages of 79%, 78%, 94%, and 71%.

There are various factors that cause low science process skills in chemistry internship students of Muhammadiyah University of Semarang, one of which is due to a lack of confidence. This attitude makes skills in the social aspect low. In addition, the inaccuracy of the experimental results with what was expected was also very influential in terms of data processing and the lack of references also had an effect.

Very low science process skills are the ability to communicate. Mastery of concepts that have not been fully mastered and low cognitive mathematical abilities are the main factors. Therefore, it is necessary to eliminate the culture of memorizing Indonesian students from an early age starting from the teacher as a facilitator for transferring knowledge. Meanwhile, the highest science process skills possessed by prospective teacher students are the skills to use tools and materials. That is because before practicum in the laboratory there is a Laboratory Management course that explains what is in the laboratory complete with how to use it.

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