



Prospective Mathematics Teachers' Critical Thinking Disposition in Designing Cognitive and Psychomotor Assessment Instruments

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Abstract: The disposition of critical thinking is one of the predictors of the success of prospective mathematics teachers in accustoming their students to critical thinking and mathematical literacy in responding to mathematical problems. Therefore, it is necessary to conduct research that focuses on the critical thinking disposition of prospective mathematics teachers in designing learning, including assessment instruments. The research aims to describe the critical thinking disposition of prospective mathematics teachers in designing cognitive and psychomotor assessment instruments to familiarize junior high school students with critical thinking and mathematical literacy. It was qualitative in nature, with an exploratory, descriptive methodology with 16 mathematics education students in the fifth semester of the Universitas Jember as research subjects. All research subjects attended three lectures on Evaluation of Mathematics Teaching and Learning Outcomes by applying a collaborative learning model based on team projects. The research findings have indicated that prospective mathematics teachers have a critical thinking disposition in compiling a project on cognitive and psychomotor assessment instruments based on the junior high school students critical thinking and mathematical literacy. The components of the critical thinking disposition of prospective mathematics teachers that emerged during three times lectures were truth-seeking, open-mindedness, maturity, and curiosity. Prospective mathematics teachers collaborated and cared about each other with friends in completing projects.

INTRODUCTION

There are two minimum competencies that high school students must possess during mathematics learning to face the industrial revolution 4.0 and the era of society 5.0, namely critical thinking and mathematical literacy skills (Kurniati et al., 2020; Nurani, 2021). Critical thinking is reflective and rational thinking about what to believe or do

(As'ari et al., 2017; Ennis, 1985; Kurniati & As'ari, 2018; Rahmawati et al., 2021). Mathematical literacy ability is students' mathematical reasoning ability in formulating, using, and interpreting mathematics in various contexts (Lestari et al., 2019). However, during mathematics learning, students do not yet have critical thinking skills (Kurniati et al., 2020; Saepuloh et al., 2021; Selman,

2020), and their mathematical literacy skills are low (Sari & Wijaya, 2017; Wijaya, 2016). Based on this, it is necessary to design an activity to provoke students to get used to critical thinking and mathematical literacy in solving mathematical problems.

One of the efforts to familiarize students with critical thinking and mathematical literacy is the provision of mathematical assignments that involve students' cognitive and psychomotor abilities in the process of completing their tasks (Kurniati & As'ari, 2019; Moyer & Milewicz, 2002). The tasks given must adapt to a person's critical thinking and mathematical literacy characteristics. However, teachers have not carried out this type of task during the Covid-19 pandemic. Teachers often use questions or assignments that are factual rather than critical questions, and teachers have difficulty asking productive questions that focus on concept construction (Sahin & Kulm, 2008). Teachers often ask questions with yes or no answers rather than questions that require higher-order thinking, especially critical thinking (Weiland et al., 2014). Based on these findings, it is necessary to make habituation for prospective mathematics teachers to arrange math assignments or questions that can familiarize students to think critically and be mathematically literate. The task or question in question can be categorized as a cognitive and psychomotor assessment instrument. Instruments made by prospective teachers must be equipped with scoring guidelines to measure students' critical thinking skills and mathematical literacy.

Prospective mathematics teachers need to be directly involved in observing open-class mathematics in schools so that prospective teachers can know students' critical thinking skills and mathematical literacy during mathematics learning (Noer et al., 2019; Rohman et al., 2019). Initial data obtained by prospective mathematics teachers while being

observers of mathematics learning in the classroom can be used to develop cognitive and psychomotor assessment instruments that can familiarize students with critical thinking and mathematical literacy. Based on this, it is necessary to have a partnership between the Educational Personnel Education Institution and schools so that the two agencies can commit together to improving and familiarizing students with critical thinking and mathematical literacy during classroom learning. One of the activities of the partnership program that can be carried out so that lecturers, students, teachers, and principals together compose and design learning to improve learning that has been carried out is Lesson Study for Learning Community (LSLC) (Hobri et al., 2020; Kusumawati et al., 2019; Saito et al., 2014). The orientation of the LSLC is to focus the study on how students learn and collaborate rather than the study on how teachers teach and master the material. So it can be said that through LSLC, teachers can improve students' understanding of the state of learning and student welfare through a collaborative approach (Saito & Atencio, 2014). In the implementation of LSLC, learning activities are carried out in the classroom, which involves other teachers, lecturers, prospective student teachers, and principals to be involved in the learning process (Hobri, 2020).

Prospective students of mathematics teachers are also required to think critically in designing cognitive and psychomotor assessment instruments. This is because the data obtained when being an observer in an open class at school must be processed so that it can be used as a basis for compiling the assessment instrument and its scoring guidelines. Through collaborative learning, one can develop critical thinking by discussing, clarifying ideas, and evaluating other people's ideas (Gokhale, 1995; Loes & Pascarella, 2017). Therefore, collaborative learning based on

projects in groups can help prospective mathematics teachers think critically in designing assessment instruments (Styron, 2014). Collaborative learning is associated primarily with constructivism, in which students create their knowledge. It is related to social learning theory when considering interactions between teams and is more age-appropriate for students (Piaget, 1926; Styron, 2014). Collaborative learning techniques can be categorized freely but adapted to students' abilities, so, in this study, the technique used is based on group projects. The choice of this technique is because the output of the designed lecture is a package of cognitive and psychomotor assessment instruments and their scoring guidelines that can help students at school to think critically and be mathematically literate.

There are several previous studies that both examined the critical thinking disposition of prospective mathematics teachers. Research by Kurniati et al., (2019) produces data that prospective mathematics teachers who respond to math problems are accustomed to open-minded behavior. Still, these prospective teachers are not accustomed to truth-seeking behavior. The results of this study are in line with the results of research conducted by As'ari et al., (2017), which states that prospective mathematics teachers have not behaved critically in responding to mathematical problems. In addition, Rahmawati et al., (2021) stated that mathematics education students were not accustomed to checking the truth of all available information when solving math problems. Based on the results of these three studies, it can be concluded that so far, research related to the critical thinking disposition of prospective mathematics teachers is still associated with problem-solving processes that measure cognition. Furthermore, the search for critical thinking dispositions related to psychomotor measurements or the performance of prospective

mathematics teachers has not been studied.

Based on the explanation above, it is necessary to research the application of collaborative learning based on group projects to familiarize prospective mathematics teachers with designing cognitive and psychomotor assessment instruments. The purpose of this study is to describe qualitatively the critical thinking disposition of prospective mathematics teachers in designing cognitive and psychomotor assessment instruments during project-based collaborative learning in groups so that it can be seen the tendency of critical thinking dispositions of prospective mathematics teachers during collaborative learning based on group projects, producing cognitive and psychomotor assessment instruments along with assessment guidelines based on critical thinking and mathematical literacy for junior high school students, and finding the stages of collaborative learning based on group projects in mathematics lectures.

LITERATURE REVIEW

Critical thinking is reflective and logical thinking that focuses on deciding what to believe or do (Ennis, 1985). According to Facione (2000), a critical thinker always makes decisions reflectively on what to do or believe. One component of critical thinking that is very important to be developed in students is the disposition of critical thinking (Bassham et al., 2011; Chukwuyenum, 2013; Lai, 2011; Turabik & Gün, 2016). Critical thinking disposition is a person's behavioral tendencies based on critical thinking. In this study, students' critical thinking dispositions were associated with the ability to design cognitive and psychomotor assessment instruments during project-based collaborative learning in groups. The critical thinking disposition component used in this study refers to the components proposed by Facione (2000), namely truth-seeking,

open-mindedness, analyticity, systematicity, self-confidence, curiosity, and maturity.

Collaborative learning provides students with diverse abilities to work together in solving tasks/problems given by lecturers (Laal & Ghodsi, 2012). Students have the desire to want to learn with other friends and, at the same time, have a caring nature toward friends who have learning difficulties. This indicates that student success depends on the cooperation and collaboration of all students in a team. Collaborative learning is a learning model that focuses on joint involvement between study group teams in achieving targets or solving problems at hand. The five basic concepts in collaborative learning are (1) mutual care, (2) ownership of the responsibility of participants with the team, (3) division of small-scale groups and heterogeneous abilities (2-4 people), (4) communication and interaction between participants, and (5) group problem solving (Laal, 2012; Le et al., 2018). The project-based learning

model (PjBL) is a learning model that requires students to work together in teams or groups to complete projects given by the teacher (Serin, 2019). The design of the PjBL learning model is focused on the active involvement of students in involving higher-order thinking skills, including critical thinking in completing the given project (Bell, 2010). Students can benefit greatly from PjBL strategies in influencing goal orientation, increasing curiosity to seek, increasing engagement, promoting mastery of new knowledge, encouraging problem-solving skills, developing critical thinking, enhancing peer learning, and improving communication skills (Bell, 2010). Therefore, in this study, the PjBL strategy combined with the collaborative learning model can familiarize prospective mathematics teachers with critical thinking dispositions in designing cognitive and psychomotor assessment instruments. In general, the framework of thinking for this research activity is shown in Figure 1.

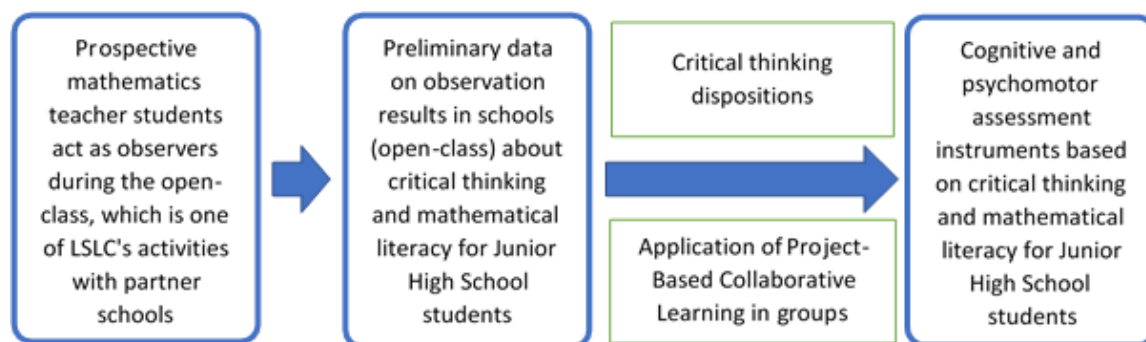


Figure 1. Research Framework

METHOD

This research was a qualitative descriptive study because it describes qualitatively the ability of prospective mathematics teachers to design cognitive and psychomotor assessment instruments that can familiarize junior high school students to think critically and be mathematically literate. In addition, this study will also describe the process of implementing project-based collaborative

learning in groups in the Evaluation of Mathematics Teaching and Learning Outcomes (EHBM) lectures for 3 meetings qualitatively. The place of research is the Mathematics Education Study Program, FKIP University of Jember. The subjects in this study were 16 class B students in semester 5 who took EHBM courses in the odd semester 2021/2022, divided into 8 groups with 2 students each. Determination of group

members is done randomly, either from gender or mathematical ability.

The main instrument in this study was the researcher himself. In contrast, the supporting instruments used in this study were (1) learning design for 3 meetings with a group project-based collaborative learning model, (2) critical thinking disposition observation sheet, (3) project assignment sheet which students must complete, and (4) interview sheets. Research instruments have been validated by three lecturers from the EHBM course team. The validation results state that the four instruments used in the study have met the validity criteria (high category validity score) because they follow the stages of collaborative learning based on group projects and critical thinking disposition components.

The data needed to answer this research question are (1) observational data on students' critical thinking disposition tendencies for 3 lectures, (2) data on group project assignments and project completion reports, and (3) interview data on critical thinking dispositions. Students in designing cognitive and psychomotor assessment instruments. Based on the required data, the data collection methods are the observation method, the test method, and the interview method. The observation method was used to determine the students' critical thinking disposition during 3 lessons and the process of completing projects in groups. The focus of observing the project completion process is based on written reports and activities while being an observer in 4 open-class classes at school. The test is used to determine the ability of prospective mathematics teachers to design cognitive and psychomotor assessment instruments based on critical thinking and mathematical literacy. Furthermore, interviews were conducted to confirm the results of data analysis about the tendency of students' critical thinking dispositions during lectures in

completing projects obtained from the test and the observation method.

The stages of this research are (1) preparation and validation of research instruments, (2) determination of research subjects, (3) all research subjects attend EHBM lectures for 3 meetings applying a group project-based collaborative learning model, (4) at the first meeting of lectures, research subjects received a project assignment to develop cognitive and psychomotor assessment instruments that could familiarize junior high school students with critical thinking and mathematical literacy, (5) after the first meeting, all subjects took turns making direct observations of critical activities and mathematical literacy of students at SMP Negeri 7 Jember during the first meeting. 4 times open-class mathematics, (6) the results of observations at school are used as the basis for developing cognitive and psychomotor assessment instruments, (7) the second lecture, the research subject presents the results of observations and the stages of completing the given project, (8) the third lecture, all groups of students submit the project generated and collect activity reports, (9) analyzes test and observation data for 3 meetings, (10) performs the data triangulation stage, namely confirming the main data, namely test and observation data with interview data, (11) determining conclusions or research findings. The data is analyzed by applying data reduction and data presentation, which leads to research findings and conclusions. In the first stage, data reduction was carried out by entering related variables according to the research objectives and removing unnecessary variables. The second stage, data presentation, is related to the grouping of data that has been reduced to two groups, namely (1) the tendency of critical thinking dispositions of prospective mathematics teachers in compiling cognitive and psychomotor assessment instruments and (2) project results,

namely activity reports and projects produced, namely instruments cognitive and psychomotor assessment based on critical thinking and mathematical literacy of junior high school students. The last stage is drawing conclusions based on the findings and presenting the data.

RESULT AND DISCUSSION

All research subjects, namely 16 prospective mathematics teachers, collaborated well in completing the given project tasks, namely compiling assessment instruments and cognitive and psychomotor scoring guidelines based on critical thinking and mathematical literacy for junior high school students. Each student in the group plays an active role in completing project assignments and holding discussions together for three EHBM lectures. It is shown in Figure 2, where each student learns from the other in a group. Each student expresses their opinion when compiling cognitive and psychomotor assessment instruments. The opinions expressed by students were based on data obtained when they were observers in 4 open-class mathematics activities at SMP Negeri 7 Jember. In addition, the data used by students in completing projects is based on the results of reflections carried out after the open class.

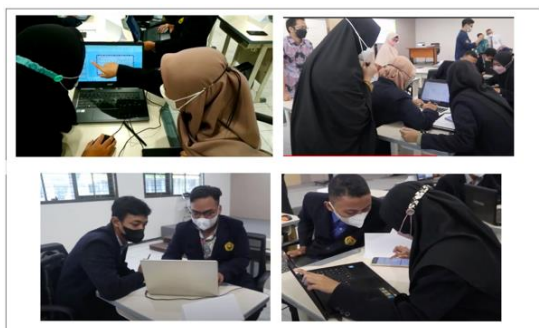


Figure 2. Research Subject Collaboration in Completing a given Project

The course supervisors facilitate the research subjects in designing and completing assigned project assignments. The course supervisors delivered several

kinds of mathematical assessment instruments used in schools. In general, the assessment instruments, either in the form of tests or non-tests, had not familiarized the students of SMP Negeri 7 Jember to think critically and be mathematically literate. The reason obtained from the teacher who will do the open class is because the condition of the ability and enthusiasm for learning at SMP Negeri 7 Jember in mathematics is still low. So that teachers still focus on routine practice questions and do not require students to think critically, especially during the COVID-19 pandemic. Based on these problems, the lecturers and prospective teachers are committed to collaborating with mathematics teachers at SMP Negeri 7 Jember to compile cognitive and psychomotor assessment instruments that can familiarize students with critical thinking and mathematical literacy during mathematics learning. This collaboration is manifested in a partnership activity with the Lesson Study for Learning Community (LSLC) program, which involves students as observers and course supervisors as a partnership team who, together with partner teachers, design lessons and conduct redesigns based on the results of learning reflections. The results of the partnership activities are used as the basis for designing lectures on campuses specifically for EHBM courses.

In the first meeting lecture, the lecturer asked the research subject to sit with a group of friends and conduct collaborative discussions on the problems given by the lecturer. The problem in question is an example of cognitive and psychomotor assessment instruments often used by mathematics teachers in schools. Examples of cognitive and psychomotor assessment instruments in junior high school mathematics subjects, respectively, are shown in Figure 3 and Figure 4.

Satuan Pendidikan	: SMP
Mata Pelajaran	: Matematika
Kelas	: XII
Kompetensi Dasar	: Memahami dan mengimplementasikan konsep jarak dan kedudukan pada ruang dimensi tiga
Indikator Kognitif:	
Siswa dapat memahami dan mengimplementasikan konsep jarak dan kedudukan pada ruang dimensi tiga	
Soal	
Diketahui suatu kubus ABCDEFGH memiliki panjang rusuk 12 cm. Titik P, Q, dan R secara berturut-turut adalah titik tengah dari rusuk AE, BF, dan CG. Dari pernyataan berikut manakah yang benar?	
A. Segitiga PQR merupakan segitiga sama kaki	
B. Rusuk EF terletak pada bidang CDGH	
C. Diagonal ruang dari kubus tersebut adalah $12\sqrt{3}$ cm	
D. Luas segitiga PQR adalah 72 cm^2	
E. Titik F terletak pada bidang PQR	

Figure 3. Examples of Cognitive Assessment Instruments

Indikator Psikomotorik	:
1. Siswa mampu mengaplikasikan rumus luas permukaan dan volume bagian ruang sisi datar yang berkaitan dengan benda kongkret	
Contoh penilaian kinerja	
• Menghitung Luas Permukaan Kubus dan Balok	
Untuk menghitung luas permukaan kubus dan balok pada benda nyata. lakukan kegiatan berikut ini.	
Bahan-bahan yang dibutuhkan:	
1. Pensil,	
2. Penggaris,	
3. Gunting, dan	
4. Lem/perekat	
Ambillah dua kotak kue atau kardus kecil berbentuk kubus dan balok (kotak kue atau kardus kecil) kemudian amatilah	
1. irislah beberapa rusuk pada bangun berbentuk balok sehingga apabila dibuka dan direbahkan pada bidang datar akan membentuk bangun datar, dan didapat jaring-jaring balok	
2. Selanjutnya irislah beberapa rusuk dengan pola irisan yang berbeda pada bangun berbentuk kubus sehingga apabila dibuka dan direbahkan pada bidang datar akan membentuk bangun datar, dan didapat jaring-jaring kubus	
3. Bandingkan kedua bentuk jaring-jaring tersebut, kemudian ukurlah dan hitunglah luasnya	
4. Jaring-jaring kubus dan balok tersebut kemudian ditempatkan pada kertas asturo/ lainnya, lalu hasilah dengan sebaik mungkin.	

Figure 4. Examples of Psychomotor Assessment Instruments

All research subjects were asked to analyze the two samples of the instrument given. The research subjects themselves determine the things to be analyzed. Students collaborate with friends in a group to analyze examples of existing instruments. 4 other students have not had the disposition to think critically in responding to examples of existing instruments. The four students thought that the cognitive and psychomotor indicators presented were correct, and the questions/problems that were prepared followed the indicators of learning outcomes. The four students did not check

the truth of the answers to the cognitive questions, even though their group mates believed there were 3 correct answers to the cognitive questions. The questions given were not following the indicators of learning outcomes.

Furthermore, the four students could not think openly to try to understand and analyze their friends' answers, who stated that the condition for the preparation of indicators was to only measure one ability (no more than one ability). However, there has been a collaboration between the 4 students in deciding the answers to the problems given in analyzing cognitive and psychomotor assessment instruments. Four students discussed together to solve the problems given, but their understanding of the preparation of indicators and cognitive or psychomotor problems/problems was still not optimal. So the decisions taken by the four students were wrong.

Furthermore, the other 12 students tended to think critically in responding to the examples of instruments given by the lecturer. The components of critical thinking disposition that emerged in 12 students were truth-seeking, open-mindedness, maturity, and curiosity. Truth-seeking that appears in students when they are asked to analyze cognitive and psychomotor assessment instruments is (1) checking the correctness of the indicators that are prepared and adjusted to the requirements for the preparation of learning outcomes indicators, (2) checking the truth of the cognitive questions given and at the same time checking whether there is a correct answer, and (3) checking the suitability of the indicators with cognitive or psychomotor questions. Meanwhile, the students' open-mindedness behavior emerged during collaborative discussions. The twelve students shared their various opinions in analyzing the given instruments. Logical explanations of reasons accompany differences of opinion. Friends in one group can accept

differences of opinion even though they ultimately decide on the same answer in response to the existing instrument examples. Decisions taken by students based on agreement from differences of opinion are characteristic of behavior maturity of judgment. Furthermore, students' curiosity when conducting analysis was shown when students tried to find the required information on google using either a cellphone or laptop. Student curiosity resulted in giving logical and rational reasons for conducting the analysis.

In the second lecture, which was conducted after all students took turns being observers at 4 open classes held by SMP Negeri 7 Jember, all research subjects presented their findings regarding the assessment instruments used in schools and data on students' critical thinking and mathematical literacy during mathematics learning. All research subjects had different opinions regarding the data obtained when they were observers at school, as shown in Figure 5.

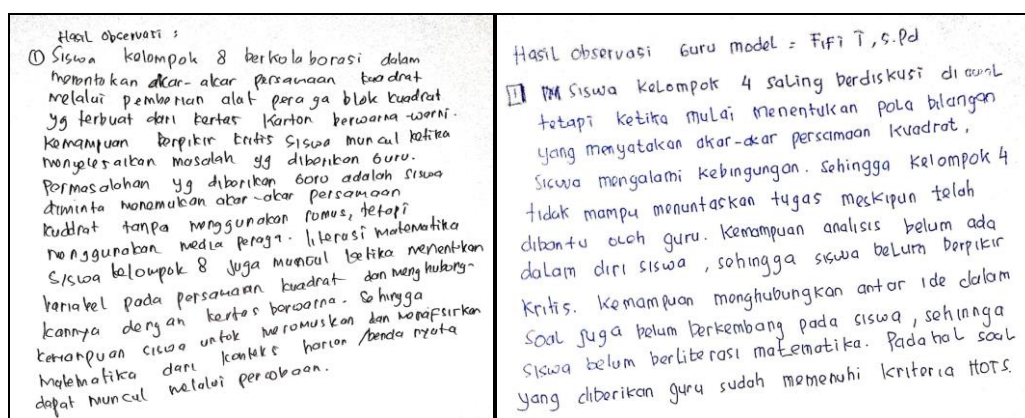


Figure 5. Examples of Observation Results of Prospective Mathematics Teachers when Participating in Open-Class at School

Based on Figure 5, student teacher candidates stated that students at school had collaborated well in solving the problems given by the teacher. Although 2 groups have not been able to solve the questions given because they have difficulty interpreting the questions that exist in the use of the provided teaching aids media. The model teacher has tried to assist groups of students who have difficulty. Still, students continue to experience difficulties, and other groups do not try to help groups with difficulties because students focus on solving problems given by the teacher. In addition, prospective mathematics teachers also said that some students had critical thinking and were mathematically literate when solving problems given by the teacher. Still, some had not thought critically and were mathematically

literate. Therefore, based on the observations of prospective mathematics teachers, one type of question or instrument, either cognitive or psychomotor, can familiarize students with critical thinking, and mathematical literacy is a non-routine problem and a problem that requires students to practice mathematics media in the problem-solving process. Critical thinking is very important for students because critical thinking is one of five thinking skills that can affect individual success in the future (Akinoğlu & Karsantik, 2016; Loes & Pascarella, 2017).

In the third meeting lecture, the research subjects presented the results of their collaboration with their group mates in doing a project to prepare cognitive and psychomotor assessment instruments that can familiarize junior high school

students to think critically and be mathematically literate. When presenting, students are allowed to reflect if there are errors in the preparation of the assessment instrument. All students come forward to present the group results, and each student in the group is allowed to express their opinion when compiling the project (see Figure 6).



Figure 6. Presentation of Prospective Mathematics Teachers

Examples of cognitive assessment instruments that can familiarize junior high school students with critical thinking and mathematical literacy that research subjects in group 5 have developed are shown in Figure 7. From observations at school, students are interested in themes related to their world (e.g., sports because at SMP Negeri 7 Jember, most students excel in sports and enter the school through sports), (2) the indicators that have been compiled have met the high-level thinking criteria because it is classified as C4 (analysis), (3) the cognitive criteria of the designed questions have met the critical thinking requirements, namely the analysis and interpretation components of the information on the questions, and (4) the problems presented in the questions are mathematical literacy questions because requires high school students to engage analytical skills is an evaluation under various conditions. The reasons presented by the research subjects in group 5 indicate that they tend to have a critical thinking disposition in designing cognitive assessment instruments. The research subjects can think logically and reflectively to decide the right type of problem to familiarize students with critical thinking and mathematical literacy. The components of prospective

teachers' truth-seeking, open-mindedness, maturity, and curiosity appear in students when compiling these cognitive instruments. Through observation activities during the open class, prospective mathematics teachers get positive lessons about critical thinking and mathematical literacy. So it can be said that through active involvement in LSLC activities, one will gain valuable experience. In addition, through lesson study activities, they can improve 21st-century life skills, including the disposition to think critically, so that prospective mathematics teachers can directly develop critical behavior if they are often actively involved in LSLC activities.

Instrumen Penilaian Kognitif

Indikator: Siswa dapat menyelesaikan permasalahan yang berkaitan dengan materi peluang
 Kategori: C4
 Amel mengunduh bagan pertandingan sepak bola ini yang dimulai dari babak perempat final. Berikut adalah bagan yang berhasil didapatkan Amel.

Kemudian Amel menyebarkan survei kepada teman-temannya yang menyukai sepak bola dan selalu menonton pertandingan sepak bola pada tahun-tahun sebelumnya. Berikut adalah tabel peluang tim-tim di atas untuk menang babak perempat final yang berhasil disimpulkan oleh Amel berdasarkan survei yang dibuatnya. Sedangkan untuk babak selanjutnya, yaitu semifinal dan final semua tim memiliki peluang menang yang sama yaitu 50%.

Prediksi Babak Perempat Final Piala dunia 2018			
Pertandingan	Team	Peluang Menang	Total Peluang
1	Uruguay	0,3	1
	Prancis	0,7	
2	Brazil	0,6	1
	Belgia	0,4	
3	Swedia	0,2	1
	English	0,8	
4	Rusia	0,5	1
	Kroasia	0,5	

Bento teman Amel mempercayai hasil survey yang dilakukan Amel. Ia mengajak Amel untuk bertaruh, bahwa jika Brazil menang dan menjadi juara dunia maka Amel harus membelikan 1 kue di kantin. Sedangkan jika Brazil tidak akan menjadi juara maka Bento akan membelikan Amel 5 kue di kantin. Stok kue yang terdapat di kantin sebanyak 10 kue. Berapa kue yang akan didapatkan Amel dan Bento?

- 0 dan 5
- 5 dan 0
- 50% dan 0%
- 1 dan 0
- 25/5 dan 0

Figure 7. Examples of Cognitive Assessment Instruments

Furthermore, the psychomotor assessment instrument produced by research subjects in group 2 focused on asking students to rediscover the "pi" formula by comparing the circumference and the diameter of a circle. The psychomotor assessment instruments produced by group 2 are presented in Figure 8.

Penilaian Psikomotorik	
Indikator	Siswa dapat menemukan kembali nilai "pi" dari benda yang berbentuk lingkaran
Tugas	Silahkan Anda menentukan dua benda yang ada di lingkungan rumah yang berbentuk lingkaran (sempurna). Lakukan pengukuran untuk menentukan panjang diameter dan keliling dari dua benda berbentuk lingkaran tersebut. Berdasarkan pengetahuan Anda yang telah diperoleh ketika Sekolah Dasar tentang rumus keliling lingkaran, tentukan nilai "pi" berdasarkan hasil percobaan yang dilakukan. Buatlah laporan hasil pengamatan dan pengukuran sehingga nilai akhir "pi" dapat ditemukan. Semangat dan sukses!!!!

Figure 8. Examples of Psychomotor Assessment Instruments

Based on the results of the preparation of the psychomotor assessment instruments and interviews with the research subjects, data were obtained that the reason for the preparation of the psychomotor assessment instrument was also based on the results of observations when participating in an open class. The reason is that psychomotor assessment instruments must (1) involve the physical activity of junior high school students when solving the given problems, (2) require students to check the truth of the stages of problem-solving, and (3) integrate with previous experience, especially for previously studied material so that students can relate ideas between information in psychomotor assignments. The research subjects conveyed the things when compiling the psychomotor assessment instrument also involved the disposition of critical thinking in deciding what types of problems were appropriate to familiarize junior high school students with critical thinking and mathematical literacy. This statement follows the results of previous studies, which stated that

controlling impulsivity in making decisions is the main characteristic of people with a critical thinking disposition (Marzano et al., 2011). Conclusion: A critical thinker is always used to making decisions to do truth-seeking, open-mindedness, maturity, and curiosity in completing tasks or projects. This is in line with the results of other studies, which state that the actions of people with a critical disposition in responding to problems should be based at a minimum on truth-seeking behavior (As'ari et al., 2019; Cheng & Wan, 2017; Peter A Facione, 1990; Kurniati & As'ari, 2019).

Based on the results of the study, the findings of this study are (1) mathematics teacher candidates have the disposition to think critically in compiling cognitive and psychomotor assessment instruments based on critical thinking and mathematical literacy for junior high school students, and (2) components of the disposition of critical thinking students for mathematics teacher candidates which emerged during the 3 EHBM lectures were truth-seeking, open-mindedness, maturity, and curiosity, and (3) prospective mathematics teachers were able to collaborate with friends in groups in completing projects. Teacher candidate students can easily and critically think in preparing assessment instruments if they have direct experience to observe the tendency of students' ability conditions at school. This follows the behavioral desire theory, which states that a person's critical thinking disposition is influenced by individual attitudes towards behavior influenced by past experiences and beliefs (Ajzen, 1991; Fischbein, 2012; Kurniati et al., 2020). In addition, the decision of prospective mathematics teachers in compiling cognitive and psychomotor assessment instruments is the output of critical behavior possessed by prospective teachers, especially truth-seeking, open-mindedness, maturity, and inquisitiveness (Moore, 2010). Furthermore,

collaborative behavior among prospective mathematics teachers can affect student success in designing assessment instruments. Through collaborative activities, difficult tasks or projects will be easy to do because each group member commits to caring for and helping each other (Jauhariyyah et al., 2017). Collaborative activities are mutually caring activities, namely smart students who care to help friends who have difficulties in learning, while students who have learning difficulties dare to ask smart friends. The success of prospective mathematics teachers in critical behavior in designing cognitive and psychomotor assessment instruments is influenced by academic ability (Bakir, 2015; Karagöl & Bekmezci, 2015). Prospective mathematics teachers who are the study subjects have a Grade Point Average (GPA) of more than 3.2 or are classified in the high ability category.

CONCLUSION

This research activity concludes that prospective mathematics teachers tend to think critically in designing cognitive and psychomotor assessment instruments based on the habit of critical thinking and mathematical literacy of junior high school students. The components of critical thinking disposition that appear in prospective mathematics teachers during the application of 3 project-based collaborative learning in groups are truth-seeking, open-mindedness, maturity, and curiosity. Cognitive and psychomotor assessment instruments compiled by prospective mathematics teachers have fulfilled the critical thinking and mathematical literacy components of junior high school students. The limitation of this study is that the cognitive and psychomotor assessment instruments designed by prospective mathematics teachers have not been tested for junior high school students. So the recommendation proposed is to test the instrument produced by prospective

mathematics teachers in learning mathematics in junior high school. The next recommendation is that LSLC-based partnership activities with schools can be used as an alternative model of partnership between LPTKs and schools so that students and lecturers can learn directly from the real conditions of students at school.

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