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TEACHING HIGHER ORDER THINKING SKILLS (HOTS) IN MATHEMATICS CLASSROOMS: GENDER DIFFERENCES

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Abstract

This study looks at how Indonesian mathematics teachers teach HOTS based on gender differences. The design used was a case study. In this study, out of 87 high school mathematics teachers in East Java, Indonesia surveyed, two teachers, male and female mathematics teachers taught HOTS consistently. Therefore, these teachers were recruited to participate in the present study. Data were obtained from observation, video recording, and interviews. A teacher decision-making is explained based on the teacher decisions and its process in teaching HOTS. According to the revised Bloom Taxonomy, HOTS include analyzing (C4), evaluating (C5), and creating (C6). Findings suggest that different decisions enacted by male and female mathematics teachers in teaching HOTS were observed. The male teacher chose the resilient problem and the female teacher chose contextual problems that entered the domain of analysis (C4). When directing the students to evaluate (C5), the male teacher chose to ask students to check their answers with the answers of their friends, while the female teacher chose to ask students to check their answers in group and with the other groups. When directing the students to create, the male teacher gave them several questions so that they could build ideas, while the female teacher asked students to use a new strategy towards the solution of the problems (C6). Male and female teachers differed in their decision-making processes in teaching HOTS. The teacher's decision in encouraging students to engage in high-order thinking could be used to inspire other teachers who have not taught HOTS to their students. The results could also provide additional information and knowledge to prospective teachers regarding how to teach HOTS to students.

Keywords: Teaching HOTS, Analizing, Evaluating, Creating.

Abstrak

Penelitian ini melihat bagaimana guru matematika Indonesia mengajarkan HOTS berdasarkan perbedaan gender. Desain yang digunakan adalah studi kasus. Dalam studi ini, dari 87 guru matematika SMA di Jawa Timur, Indonesia yang disurvei, dua guru, guru matematika laki-laki dan perempuan mengajar HOTS secara konsisten. Oleh karena itu, para guru ini direkrut untuk berpartisipasi dalam penelitian ini. Data diperoleh dari observasi, perekaman video, dan wawancara. Pengambilan keputusan guru dijelaskan berdasarkan keputusan guru dan prosesnya dalam mengajar HOTS. Menurut Taksonomi Bloom yang telah direvisi, HOTS mencakup analisis (C4), evaluasi (C5), dan penciptaan (C6). Temuan menunjukkan bahwa keputusan berbeda yang dibuat oleh guru matematika pria dan wanita dalam mengajar HOTS diamati. Guru laki-laki memilih soal resilien dan guru perempuan memilih soal kontekstual yang masuk ke dalam domain analisis (C4). Pada saat mengarahkan siswa untuk menilai (C5), guru laki-laki memilih untuk meminta siswa mengecek jawaban mereka dengan jawaban temannya, sedangkan guru perempuan memilih untuk meminta siswa mengecek jawaban mereka dalam kelompok dan dengan kelompok lain. Saat mengarahkan siswa untuk berkreasi, guru laki-laki memberikan beberapa pertanyaan agar mereka dapat membangun ide, sedangkan guru perempuan meminta siswa untuk menggunakan strategi baru menuju pemecahan masalah (C6). Guru laki-laki dan perempuan memiliki perbedaan dalam proses pengambilan keputusan dalam mengajar HOTS. Keputusan guru dalam mendorong siswa untuk terlibat dalam pemikiran tingkat tinggi dapat digunakan untuk menginspirasi guru lain yang belum mengajarkan HOTS kepada siswanya. Hasil tersebut juga dapat memberikan tambahan informasi dan pengetahuan bagi calon guru tentang cara mengajarkan HOTS kepada siswa.

Kata kunci: Pengajaran HOTS, Analisis, Evaluasi, Kreasi.

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Higher order thinking skills (HOTS) are highly demanded in the 21st century. The development of HOTS is expected to support the mastery of four keys of 21stcentury competencies, namely critical thinking, creativity, communication, and collaboration (Scott, 2015). One of Indonesia's current education reforms involves increasing the application of HOTS-oriented assignments in classroom learning, including mathematics learning (Sumaryanta, 2017).

Teaching HOTS through HOTS-oriented assignments is expected to encourage mathematics learning and develop thinking skills at a higher level. In Indonesia, the inclusion of HOTS questions in national exams was started in 2017. Their use has been expanded to a greater extent in the 2018 national exam. The development of students' thinking is the essence of mathematics learning in the classroom. HOTS development is one of the responsibilities inherent in mathematics learning. Thus, teaching HOTS is a direct implication of the mandatory HOTS development through mathematics learning.

HOTS constitute an important aspect of education. Students' success is also determined by their ability to solve a problem which requires a higher level of thinking (Tanujaya, Mumu, & Margono, 2017). If a teacher deliberately and continuously practices high-level thinking strategies such as encouraging students to deal with real-world problem, class discussions, and inquiry-based experiments, there is a good opportunity that the students will consequently develop the critical thinking skills that are part of high-level thinking (Miri, David, & Uri, 2007). Teaching HOTS is not only effective in improving students' academic performance but also eliminate their weaknesses (Yee et al., 2015). In addition, Pogrow (2005) encouraged the teaching of HOTS as an effort to prepare learners for difficult academic challenges, work, and responsibilities in their future. Therefore, HOTS can be used to predict the success of a student. Students who have good HOTS levels are expected to succeed in their further education.

Many teachers have weak conceptions of high-level thinking (Harpster, 1999; Thompson, 2008; Goethals, 2013). Teaching higher-order thinking possess high challenges as it requires teacher's creativity in giving assignment while studying (Henningsen & Stein, 1997; Thompson, 2008; Alhassora, Abu, & Abdullah, 2017). Along with the developments in the world of education, research related to HOTS has been carried out to determine students' thinking processes in the solution of mathematical problems involving HOTS (Bakry & Bakar, 2015). Several learning models to improve higher order thinking skills have also been developed and proven to work effectively (Samo, Darhim, & Kartasasmita, 2017; Saragih, Napitupulu, & Fauzi, 2017; Saragih, Napitupulu, & Fauzi, 2017; Apino & Retnawati, 2017; Rubin & Rajakaruna, 2015).

Previous literature encourages the strengthening of learning and assessment oriented towards the development of HOTS in Indonesia. The application of assessment through HOTS-oriented assignments in mathematics learning requires the readiness of all school stakeholders, especially

mathematics teachers. As direct implementers of assessment in the class, teachers is required to have a good understanding of HOTS assessment, the preparation of HOTS-oriented assignment instruments, procedures, and follow-up (Sumaryanta, 2017).

Studies on HOTS and the development of several learning models designed to teach HOTS have been conducted. Bakry and Bakar (2015) uncovered that there is a difference between students with high mathematical abilities in solving HOTS problems to those with medium and low mathematical abilities. Kurtulus and Ada (2017) revealed that only about two-thirds of prospective teachers are in the high-level cognitive learning domain category (such as analyzing, evaluating or creating). Alhassora et al. (2017) contended that there are three main factors contributing to the challenges faced by mathematics teachers in guiding students to develop high-level thinking skills, namely teachers, students, and others (time constraints, student diversity, and lack of resources). Apino and Retnawati (2017) asserted that instructional design developed by teachers to teach HOTS generally includes three main components: (1) encouraging learners to be involved in non-routine problem-solving activities; (2) facilitating the development of analysis, evaluation, and creation abilities; and (3) encouraging learners to acquire their own knowledge. However, studies on how teachers make decisions in teaching HOTS seem sparse.

In determining mathematics learning and assessment, the teacher certainly engages in the thinking process. One of the aspects that can influence HOTS learning and assessment is teacher decision-making. Based on our preliminary observations, there are two teachers, one male and one female, who teach HOTS to students effectively. They teach mathematics in secondary schools in East Java, Indonesia. Gender is one of the aspects that affect and provide differences in the quality of teachers in learning mathematics (Beswick, 2005; Maulana, Helms-Lorenz, & van de Grift, 2015; Abdullah et al., 2017). Thus, this study explores mathematics teachers' decision-making process in teaching HOTS based on gender differences.

Higher Order Thinking Skills (HOTS)

To teach HOTS, teachers need to prepare HOTS-oriented assignments. A teacher requires various techniques and forms of mathematical assignments as assessment instruments. The strategies and methods for teaching HOTS are chosen so that learning can meet students' high-level thinking needs. Assessments such as performance, projects, problem descriptions, and multiple choice questions can be used to measure higher-order thinking skills (Abosalem, 2016). The importance of research on higher order thinking is growing in depth and breadth. Higher order thinking is an impetus for reforming future education in mathematics (NCTM, 2000).

There is a difference between low-level and high-level thinking skills (Lewis & Smith, 1993). The term "high-level thinking skills" shows that there is a set of lower order skills that take precedence. Newmann (1990) distinguishes between the two skill categories, concluding that lower skills require simple applications and routine steps. In comparison, high-level thinking skills challenge students to interpret, analyze, or manipulate information (Newmann & Wehlage, 1993). Wheary and Ennis (1995)

pointed to the need to improve students' higher-order thinking skills because developing these skills improves the diagnosis of higher levels of student thinking. It gives feedback for students about their levels of thinking and encourages them to think effectively. Thus, the teacher obtains information on the extent to which he or she has achieved the goals of education by conducting studies on how to teach higher-order thinking skills.

The approach to high-level thinking is divided into learning to remember and learning to transfer (Anderson & Krathwohl, 2001). This approach has informed the construction of the cognitive dimensions of Bloom's revised taxonomy. Most teachers who work according to country standards and their curriculum documents approach high-level thinking as the items constituting the "top end" of Bloom's taxonomy: analysis, evaluation, and creation, or, in previous terms, analysis, synthesis, and evaluation. The purpose of teaching at the end of one cognitive taxonomy is to equip students to make transfers. Being able to think means that students can transfer the knowledge and skills they develop during their learning to a new context. High-level thinking is the ability of students to relate their learning to the elements beyond those they were taught to associate it with.

Other researchers have given various definitions of HOTS (see, for instance, King et al, 1998; NCTM, 2000; Anderson & Krathwohl, 2001; Lopez & Whittington, 2001; Weiss, 2003; Miri et. al., 2007; Rajendran, 2008; Thompson, 2008; Thorne & Thomas, 2010; Kruger, 2013). King et al. (1998) state that HOTS includes critical, logical, reflective, metacognitive, and creative thinking that is activated when individuals face unknown problems, uncertainties, questions, or dilemmas. HOTS entails solving non-routine problems (NCTM, 2000) and constitutes the process of analyzing, evaluating, and creating (Anderson & Krathwohl, 2001). Moreover, HOTS occurs when someone picks up new information and information stored in the memory and relates to and/or rearranges and expands this information to achieve a goal or find possible answers in a confusing situation (Lopez & Whittington, 2001).

HOTS includes collaborative, authentic, unstructured, and challenging problems (Weiss, 2003). Strategies, meta-goal arrangements; while critical, systemic, and creative thinking in HOTS are tactics/activities needed to achieve the stated goals (Miri et. al., 2007). HOTS is the use of an expanded mind to confronting new challenges (Rajendran, 2008), non-algorithmic thinking (Thompson, 2008). Thorne and Thomas (2010) state that this requires thinking at a higher level than just restating facts. It requires people to do something with the facts. People must understand,, connect, categorize,, manipulate, integrate, and apply them when they seek new solutions to problems. Kruger (2013) states that HOTS involves concept formation, critical thinking, creativity/brainstorming, problem-solving, mental representation, the use of rules, reasoning, and logical thinking.

As discussed in this study, HOTS refer to the highest cognitive domain of the revised Bloom Taxonomy (Table 1), which includes analyzing, evaluating, and creating.

Table 1. Indicator of HOTS Activity (Anderson & Krathwohl, 2001)

HOT Cognitive Domain	Description
Analyzing	Breaking information into parts to explore understandings and relationships, comparing, organising, deconstructing, interrogating, and finding
Evaluating	Justifying a decision or course of action, checking, hypothesising, critiquing, experimenting, and judging
Creating	Generating new ideas, products, or ways of viewing things, designing, constructing, planning, producing, and inventing

The teacher is encouraged to choose a strategy or method that engaged students to analyze, evaluate, and create.

Decision-Making

Decision-making is a process that selects the preferred option or series of actions among a set of alternatives based on the criteria or strategies provided (Wang, Wang, Patel, & Patel, 2006; Wang & Ruhe, 2007). Decisions can be considered to be the outcome or output of mental or cognitive processes that lead to the selection of an action among several available alternatives (Facione & Facione, 2008). Previous studies on decision-making issues have been exclusively carried out (see Cokely & Kelley, 2009; Ketterlin-Geller & Yovanoff, 2009; Wang & Ruhe, 2007). Decision-making involves one's cognitive processes (Wang & Ruhe, 2007). Decision-making processes include generating ideas, clarifying ideas, and assessing the fairness of ideas (Swartz, Fischer, & Parks, 1998).

Research on decision-making in mathematics learning has also been conducted on teachers, prospective teachers, and students (see Abdillah, et al., 2016; Arzarello, Ascari, Thomas, & Yoon, 2011; Kosko, 2016; Dede, 2013). Furthermore, decision-making in the intuitive, analytical, or interactive solution of problems has been examined among students (Abdillah et al., 2016). Research on prospective-teacher students has been conducted by looking at the decision-making of elementary school mathematics prospective-teacher when giving questions and choosing math assignments for learning (Kosko, 2016). Decision-making has also been investigated by comparing the decision-making of two teachers in mathematics learning based on resources, orientations, and goals (Arzarello et al., 2011). Other research has concerned with the exploration of the values that underlie the decision-making process of Turkish and German teachers in group learning (Dede, 2013).

Research on decision making by students shows that students make decisions in solving problems that begin with intuitive thinking then interactively and analytically continue until they get the desired results (Abdillah et al., 2016). The choice of assignments by prospective teachers and their reasons has a statistically significant effect on the choice of the order of questions for prospective teachers (Kosko, 2016). Comparison between orientation and goals behind teacher decisions can reveal how teachers achieve different results and the expectations they have from students (Arzarello et al., 2011). There are four different main categories that affect teacher decision making, namely: (1) productivity, (2) socialization, (3) flexibility/authority, and (4) gender differences (Dede, 2013). Kosko (2016) and Arzarello et al. (2011) also investigated decisions made by teacher candidates. Further

research is needed to find out the teacher's decision making as an individual actor in teaching (Lande & Mesa, 2016).

Decision-making enacted by the teacher is important and should be studied intensely. For such a purpose, the present study looks ta the teacher's decision-making in the teaching of HOTS in the Indonesian secondary schooling contexts. This includes decisions which the teacher makes as well as decision-making processes which include generating, clarifying, and assessing the fairness of ideas (Swartz et al., 1998) in Table 2.

Table 2. Decision-Making Process Enacted by Mathematics Teachers in Designing Learning

Decision-Making Steps	Description
Generating Ideas	Registering/classifying possible choices of ideas. Decision-makers are expected to be able to collect various kinds of ideas.
Clarifying Ideas	Analysing existing ideas. Refers to the stage of building ideas. Decision-makers must be able to compare or contrast existing ideas. Furthermore, they must be able to classify and define the ideas then give reasons and describe assumptions based on the ideas.
Assessing the Fairness of Ideas	Assessing all existing logical ideas. Assessment can be done by determining accurate observations, by determining reliable secondary sources, or based on existing facts or logical and correct principles.

Based on Table 2, decision-makers can make choices according to the existing conditions and their objectives. Thus, they make the choices with the most positive effects. In this study, the teacher decisions and decision-making process in teaching HOTS enacted by by male and female teachers is explained in the following sections.

METHOD

Research Design

Since this study described the teacher decisions and decision-making process enacted by male and female mathematics teachers in teaching HOTS, a case studyd design was opted.

Participants

Eighty-seven Indonesian mathematics teachers teaching in secondary schooling sectors in East Java, Indonesia, were surveyed to find out when they taught higher order thinking skills to students. Our survey captured that 50 teachers said never, 30 teachers said yes but rarely, and 7 teachers said yes and often taught higher order thinking skills to their students.

One of the researchers in the present study observed 7 mathematics teachers from three different secondary school schools in East Java, Indonesia (SMPN 1 Madiun, SMPN 4 Madiun, SMPN 3 Malang, SMAN 1 Geger Madiun, SMAN 2 Madiun, and SMAN 1 Talun Blitar) then chose one male and one female teacher who met the specified research criteria. To determine the recruited participants, the researcher carried out observations for 2 meetings. The observed learning was grade 7, 8, 10 and 11 in secondary schools with a total of about 30-35 students. The observations on mathematics teachers at

SMPN 4 Madiun and SMAN 1 Geger Madiun showed that from 2 meetings, the teachers apparently gave routine questions intended for students to do the analysis, but this did not lead students to think at a higher level. The results of observations on mathematics teachers at SMPN 1 Madiun and SMAN 2 Madiun showed that from 2 meetings, there was 1 meeting that focused on giving questions that led students to think at a high level, but the teacher only focused on analyzing activities. While the mathematics teachers at SMPN 3 Malang and SMAN 1 Talun Blitar provide non-routine questions and facilitates students to think at a higher level which includes analyzing, evaluating, and creating, as explained in Table 1. From these observations, the researcher believes that one teacher was found different from the other 6 observed teachers. One male mathematics teacher from SMAN 1 Talun Blitar and one female mathematics teacher from SMPN 3 Malang were recruited to participate in the present study since they enacted the best method in teaching high-level thinking skills to students such as analyzing, evaluating, and creating.

The recruited teachers from SMPN 3 Malang and SMAN 1 Talun Blitar were the winner of Mathematics Teacher Olympiads in their districts and were senior teachers with 20 years of teaching experience. This participant selection included as a special case since the teaching approach enacted by the teachers was different from that of the other four teachers, who conditioned their students to only analyze the problems. For the sake of anonymity, the two participating teachers were assigned as S1 for male teacher and S2 for female teacher.

Data Collection

Data in this study were obtained from observation, video recording, and interviews with the participating teachers. The observation focused on how the teachers taught HOTS to students. It also explored the teacher's decision to present problem assignments as well as the teacher's decision to stimulate students to engage in higher-order thinking activities. Moreover, the researchers conducted classroom observations for 2 meetings of learning as informed in Table 3. In each meeting, learning was conducted in 2 x 45 minutes.

Table 3. Observation Schedules for Mathematics Learning

Teacher	Topics	Indicators
Female Mathematics Teacher (S1)	Equations of Absolute Value	Students are able to solve the problem that related Equations of Absolute Value
	Inequalities of Absolute Value	Students are able to solve the problem that related Inequalities Absolute Value
Male Mathematics Teacher (S2)	Function	Students are able to solve the daily life problem using the concept of Function
	Solid	Students are able to solve the daily life problem by using the concept of Volume in Geometry

The researchers used video recordings to document the learning process. The researchers

conducted in-depth conversations about teachers' decision making to choose strategies and the ways in which the teachers taught the students to analyze, evaluate, and create as aspect of HOTS by using problems in mathematics learning. Table 4 presents examples of interview guidelines used by researchers (Murtafiah, Sa'dijah, Chandra, & Susiswo, 2019).

Table 4. Guidelines for Decision Making Interviews

Decision Making Stages	Questions
Generating ideas	a. What kind of ideas about math problems to teach HOTS? b. What new ideas come up about math problems to teach HOTS? c. …
Clarifying Ideas	a. What is the reason for choosing a mathematical problem to teach HOTS? b. …
Evaluating the fairness of ideas	a. What is the cause of choosing math problems to teach HOTS? b. What is the effect of choosing math problems to teach HOTS? c. …

Other questions are developed by researchers based on decisions made by the participating teachers. Next, the researchers analyzed the findings of classroom observation and exchanged ideas based on the teacher's decision making.

Data Analysis

To analyze the data, the researchers read the video transcripts multiple times and examined thematic details that became the focus of the research. In addition, the researchers also paid a close attention to the meaning of relationship between observation, video transcripts, interviews, and the related literature.

The researchers' observation of teacher decision making is based on the description in Table 2. Then, the researchers reduced the data by explaining, selecting the main points, focusing on the things that are important to the contents of the data from the field so that the reduced data can provide a sharper picture of the observations. Ultimately, the researchers concluded the results of the analysis. Since these conclusions were temporary and changeable, verification was used to obtain valid research results. The validity of the data in this study was carried out using time triangulation techniques.

RESULT AND DISCUSSION

Three classifications of the students' reflective thinking for solving the non-routine questions of analytical geometry content are described below.

Teacher Decision in Teaching HOTS

The analysis indicated that both S1 and S2 often taught HOTS to their students. Table 5 explains the teacher's decision regarding teaching HOTS in mathematics learning. The focus is on the form of assignment given and how the teacher's decision leads the students to analyze, evaluate, and create an aspect of HOTS.

Table 5. Teachers' Decision in Teaching HOTS

S1's Decision	S2's Decision
Giving the problem	Giving the problem to students
Asking the students to solve the problems by individual analysis	Asking the students to solve the problems in learning group analysis
Asking the students to check their answers and their friends' answers	Asking the students to check their solutions within and among groups
Asking the students to obtain new ideas for correct problem-solving	Asking the students to obtain new ideas for the best problem-solving

The decisions of S1 and S2 in Table 5 show that in teaching HOTS to their students, both of the teachers enacted the same steps, as shown in Figure 1.

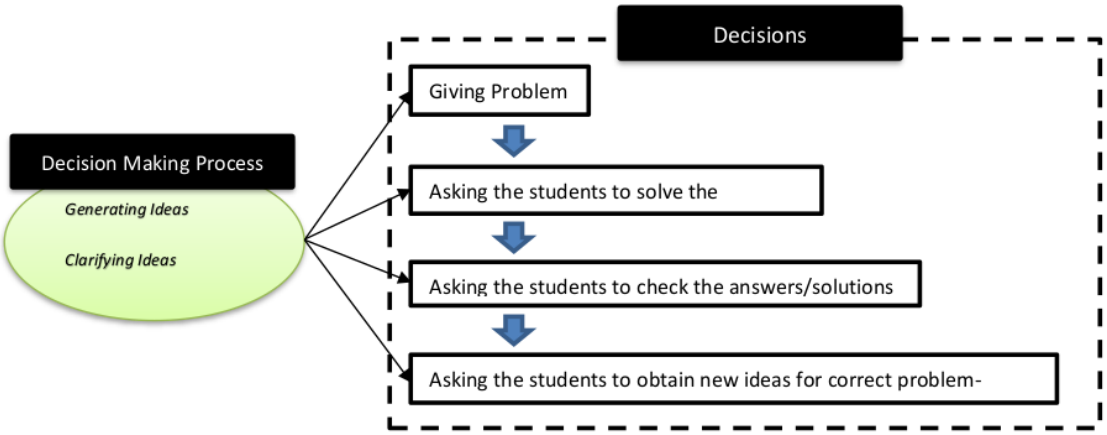

Figure 1. *The Decisions of S1 and S2 in Teaching HOTS*

Although Figure 1shows the same steps enacted by S1 and S2 in teaching HOTS, there are some differences in their decision-making. Thus, it is necessary to further explore the decision-making process of S1 and S2.

Teacher Decision-Making Process

Decision-making process regarding questions (problems) given

In teaching high-level thinking, S1 and S2 was accustomed to giving problems to their students so that they could conduct analyses. The structured questions/problems by S1 and S2 are shown in Table 5.

Table 5. Problems of S1 and S2

Learning 1	Learning 2
Giving Problems by S1	
Tentukan nilai kebenaran pernyataan: Untuk a, b, c anggota bilangan $\mathbb{R}$ berlaku $a\|b+c\| = \|ab+ac\|$ Jelaskan!	Tentukan nilai kebenaran pernyataan berikut: $\|5x-2\|^2 - 5\|5x-2\| + 6 \leq 0$, untuk x anggota $\mathbb{R}$ Jelaskan!
Translated: Determine the truth value of the following statement:	Translated:

Learning 1	**Learning 2**
For a, b, c are element of $\mathbb{R}$ Applies $a\|b+c\| = \|ab+ac\|$ Explain!	Determine the truth value of the following statement: $\|5x-2\|^2 - 5\|5x-2\| + 6 \leq 0$, for x is an element of $\mathbb{R}$ Explain!
Giving Problems by S2	
Sebuah kota terdapat dua perusahaan taksi A dan taksi B. Perusahaan tersebut menawarkan tarif taksi seperti tabel berikut Jarak(km) / Tarif (Rp): Awal (0) — 2 — 4 — … Taksi A: 13.000 — 15.000 — 17.000 — … Taksi B: 6.000 — 10.000 — 14.000 — … Penumpang taksi dapat memilih tarif taksi yang lebih murah. Amir ingin pergi ke Bioskop yang berjarak 9 km dari rumahnya. Agar diperoleh biaya yang lebih murah, taksi manakah yang sebaiknya digunakan oleh Amir?	Sebuah tabung berdiameter 24 cm dan tinggi 50 cm diisi air $\frac{3}{5}$ dari tingginya. Tiga buah bola besi berjari-jari 6 cm dimasukan kedalam tabung. Tinggi air dalam tabung sekarang adalah …. ($\pi = 3{,}14$)
Translated: There are two taxi companies in a city namely Taxi A and Taxi B. They offer fares as seen below: Distance (km) / Fares (Rp): Innitial (0) — 2 — 4 Taxi A: 13.000 — 15.000 — 17.000 Taxi B: 6.000 — 10.000 — 14.000 Taxi passengers can choose cheaper taxi fares. Amir wants to go to the Cinema which is 9 km from his house. In order to get a cheaper cost, which taxi should Amir used?	Translated: A tube with diameter of 24 cm and height of 50 cm is filled with water up to 3/5 of its height. Three 6-cm iron balls are inserted into the tube. The heigh of water in the tube currently is ... ($\pi = 3.14$)

The problems by S1 and S2 in Table 5, next is an interview excerpt with the subject to reveal the decision-making process in Table 6.

Table 6. Decision-making process regarding questions (problems) given

S1	**S2**
Generating Ideas	
S1 generate the idea about problem in learning 1 start from simple form of absolute value equation. He said "*my idea starts with* $\| a + b \| = \| b + a \|$ *was the correct statement.* $\| a + b \| = \| b - a \|$ *was a false statement.* $\| a.b \| = \| b.a \|$ *was the correct statement. For every a, b, c was a real number of the three statements, the teacher then modified the equation to be* $a \| b + c \| = \| ab + ac \|, a, b, c \in R$*, students are asked to prove the value of truth*." Also, for problem in learning 2, He said "*originally from the quadratic equation* $x^2 - 5x + 6 = 0$*, for* x *is an element of* $\mathbb{R}$*. Developed into* $\|x\|^2 - 5\|x\| + 6 = 0$*. Then developed again by changing* x *to* $5x - 2$ *and also changing equal sign into inequality sign. So that the form*	S1 choose problem question in learning 1 so that students cannot answer the question directly. She said "*I made a question by modifying from my question before. I changed the context in the problem from the clothing production company to the taxi company. I add the questions, I asking students to choose cheaper production costs."* For problem in learning 2, S2 also selects a question that cannot be solved directly by students using the existing formula. She said "*I modified the existing problem, namely the level of water in the tube which was made 3/5 of the height of the tube. I also add question, I asking students to determine the change in level of water in the tube if 3 balls are inserted."*

S1	S2
obtained $\|5x-2\|^2-5\|5x-2\|+6\leq 0$, *for* x *is an element of* $\mathbb{R}$. *I ask students to prove the truth value*."	
Clarifying Ideas	
S1 clarify the problem idea in learning 1. He said that "*I choose the question is a matter of proof and not a procedural problem when compared to the previous question*." For problem in learning 2, S1 said the reason, "*I choose questions that are not procedural questions, namely proving questions*."	S2 clarify the problem idea in learning 1. She said "*I choose the context who known by students and the problem were meant to be solved using several strategies*." And then for problem in learning 2, S2 said that "*I choose the problem in daily life, the problem was meant to be solved using several strategies*."
Assessing the Fairness of Ideas	
S1 assessing the fairness problem idea in learning 1. He said "*I choose that problem because solving these problems requires thinking skills, especially analysis. By working on the problem, in addition to students doing the analysis, the curriculum objectives are also achieved*." For problem in learning 2, S1 said "*I choose the problem because the verification question is an analytical problem (C4) which is HOTS too. If students can work on the problem, then students will practice to think at a high level especially analysis which is the aim of the curriculum*."	S2 assessing the fairness problem idea in learning 1. She said "*I choose the problem because by solving the problem, students must be analyzed and try to use some strategy to get the solution. The problem also relevant with learning indicators"*. S2 assessing the fairness problem idea in learning 2. She said "*I choose the problem because to reach the learning purpose. I train student to think by analyze the problem and try some strategy to solve the daily life problem*."

S1 and S2 enacted different decision-making processes in giving problems to their students. S1 generated the idea about problems in learning starting from a simple form of absolute value equation and inequality. Meanwhile, S2 generated the idea about problems by modifying a question from her previous question and adding question or changing the context in problems. In clarifying ideas, S1 chose problems so that the students could investigate the truth value of absolute value equation and inequality. He chose the problem because it was an analysis-type problem (C4). S2 chose the context problem in daily life. The problem was solved using several strategies to train students thinking skills.

S1 assessed the reasonableness of the idea of the problem because the verification question was an analytical problem (C4) which included in HOTS. If students could work on the problem, then they would practice to think at a high level, such as in the analysis, which is the aim of the curriculum. S2 assessed the fairness of the problem idea. S2 chose the problem because by solving the problem, students analyzed and attempted to use some strategies to get the solution. The problem was also relevant with learning indicators.

S1 and S2 enacted different types of decision making about problems. The decision of S2 about contextual problems was in line with Freudenthal (1973) and Widjaja (2013), who argued that mathematics is actually very close and cannot be separated from the context of human life. S1 and S2 were experienced teachers. Based on their 20 years of teaching experiences, it is believed that the questions given should be compatible with the students' level of cognitive development. Teachers' schemes for designing and implementing learning are influenced by their beliefs and experiences

(Borko et al., 2008; Belo, Driel, Veen, & Verloop, 2014; Muhtarom, Juniati, & Siswono, 2019). Experiences that are often used by teachers are t the abilities possessed by students for several years while teaching. to the findings suggest that teachers decide which assistance or what instructions can be given to identify students' needs in solving HOTS problems (Sa'dijah, Sa'diyah, Sisworo, & Anwar, 2020). Teachers are encouraged to have a high awareness of students' mathematical dispositions when solving math problems (Sa'diyah, Sa'dijah, Sisworo, & Handayani, 2019).

Decision-making process in asking students to solve problems

Table 7 presents an interview excerpt from the teachers' decision-making process.

Table 7. Decision-making process in asking students to solve problems

S1	S2
Generating Ideas	
S1 generate the idea of asking students to solve the problems. For learning 1, S1 said "*My ideas for asking students to work on problems are several, it can be individuals, pairs and groups*." And also, for learning 2, S1 also said that "*I ask students to work on problems, there are several alternatives, namely individuals, pairs and groups*."	S2 generate the idea of asking students to solve the problems by states "*I have several ways to ask students to analyze problems, namely by individual, pairs or group analysis*." For learning 2, S2 also states that "*there are several ways of directing students to analyze problems, namely individual, pairs and groups analysis (more than 2 students)*."
Clarifying Ideas	
S1 clarify his idea in learning 1, "*If the students worked problem individually, there are can be solved independently. By contrast, if the students were asked to work in pairs or in groups, some students depend on the others*." He also clarifies his idea in learning 2, "*If I ask students to think individually about the question or analyze the questions given to prove the truth value, so students are not dependent on other students. But if students work in pair or group, there are depend on others*."	S2 clarify her idea in learning 1, "*I ask students to analyze the problem in groups. I ask students to understand the problem about 2 taxi company, after which, they discuss the solution strategy*." For learning 2, she also clarifies, "*I ask each student to understand the problem about a tube which was inserted with three balls individually. After which, students have to discuss the possible solution strategies in groups*."
Assessing the Fairness of Ideas	
S1 assessing the fairness idea, "*I choose for asking students to work individually because I believe students can solve this problem because it is a development from the previous material. High-level thinking skills (analyzing) students could develop optimally*" S1 also choose for asking students to work individually in learning 2. He said "*It is appropriate, because it is a problem that I developed from the existing one, so students are expected to solve it. Student could be optimally thinking skills*."	S2 assessing the fairness idea, "*I choose for asking students to work in groups because the students can solve this problem by discuss with other in group*". S2 also choose for asking students to work in group in learning 2. He said "*It is because the problem is non routine question, so that the students must be discuss with their friends in group to solve the problem*."

S1 generated the idea of asking students to solve the problems. S1 used several alternatives to ask students to work on problems, such as individuals, pairs, and groups analyses. In generating the idea of asking students to solve the problems, S2 employed several methods of directing students to

analyze problems, such as individual, pairs, and groups analyses.

S1 clarified his idea of asking students to solve the problems. If students think individually about the question or analyse the questions given to prove the truth value, so students are not dependent on other students. But if students work in pair or group, there are depend on others. S2 clarify her idea. S2 asked each student to understand the problem about a tube which was inserted with three balls individually. After which, students had to discuss the possible solution strategies in groups.

In assessing the fairness idea, S1 chose for asking students to work individually because S1 believed students can solve this problem because it is a development from the previous material. High-level thinking skills (analysing) students could develop optimally, if students solve problem individually. In assessing the fairness idea, S2 chose for asking students to work in groups because the students can solve this problem by discuss with other in group.

The ways S1 and S2 asked students to solve the problems were different. However, the ways used byS1 and S2 were in line with Apino and Retnawati's (2017) study who revealed that model for teaching HOTS facilitates students' independent thinking and encourage them to build their own knowledge. Students can also use various representations, which is in line with Sirajuddin, Sa'dijah, Parta, and Sukoriyanto's (2020) investigation that giving problems needs to be given to train students in developing representations in solving problems such as symbolic, pictorial, and geometric representations. The teachers asked all the students to analyze the assignments. of entailed breaking information into parts to explore understandings and relationships, comparing, organizing, deconstructing, interrogating, and finding (Anderson & Krathwohl, 2001). This finding highlighted that students could analyze when to solve the problem (Murtafiah, Sa'dijah, Chandra, & Susiswo, 2020).

Decision-making process in asking students to check the answers

Table 8 presents a S1 and S2 interview excerpts to reveal the decision-making process in asking students to check problem solving.

Table 8. Decision-making in asking to check the answers

S1	S2
Generating Ideas	
S1 generate his idea in learning 1 about asking students to check the answer. He said, "*I asked students to check their answers individually and with friends*." In learning 2, He said "*I asked students to check their own answers and the answers of their friends*."	In learning 1, S2 stated "*there are several strategies to ask students to check namely by individually, in pairs or in group. I asked the students to evaluate the group's solution by comparing the result with other groups*." In learning 2, S2 stated "*I guide students to check, individual, pairs or groups are possible. I asked my students to evaluate the group solution by comparing the result with other groups'*."
Clarifying Ideas	
S1 clarify his idea in learning 1, "*I trained students to evaluate their own answers and the answers of their friends*." In learning 2, S1 said "*Students can*	S2 clarify her idea "*I asked the students to check the answer of group's solution by comparing the result with other groups', so the students evaluate their solution*." In learning 2, S2 stated "*I guided*

evaluate their own answers and their friends' answers."	*students to check their answers by comparing the result with other groups'. Students must evaluate the group solution.*"
Assessing the Fairness of Ideas	
S1 assessing the fairness his idea in learning 1, "*I asking students to check the answers because students are also trained to think at a high level that is evaluating in accordance with curriculum demands.*" In learning 2, S1 said "*It is appropriate, because students do an evaluation which is one of the higher-level thinking skills that is the goal of learning according to the curriculum.*"	S2 assessing the fairness his idea in learning 1, "*I asking students to check the answers of group's solution because I trained students to evaluate as a part of higher order thinking skills.*" In learning 2, S2 said "*I guided students to check their answers by comparing the result with other groups' because students do an evaluation which is one of the higher-level thinking skills.*"

When generating ideas about how students conducted evaluations in the solution of problems, S1 had several choices: namely, asking the students to check their own answers or asking them to check their own answers and their friends' answers. Out of several variations of these ideas, S1 chose to ask the students to check their own answers and their friends' answers. S2 had several strategies to ask students to check the problem solution, namely by individually, in pairs or in group. S2 asked the students to evaluate the group's solution by comparing the result with other groups.

S1 clarified the chosen idea by considering two choices. If the students were only asked to evaluate their own answers, then their skills in evaluating would be less than optimal. By contrast, if the students were asked to evaluate their own answers and their friends' answers, their thinking skills in evaluation would be better. S2 clarified her idea, S1 asked the students to check the answer of group's solution by comparing the result with other groups', so the students evaluate their solution.

In assessing the fairness his idea, S1 asked students to check the answers because students are also trained to think at a high level that is evaluating in accordance with curriculum demands. In assessing the fairness his idea, S2 asked students to check the answers of group's solution because she trained students to evaluate as a part of higher order thinking skills.

S1 and S2 asked students to check their solution. They had different ways with the same purposes, asking students to check of their own solution, their friends and other group solution. That was in line with Anderson and Krathwohl's (2001) observation that checking hypotheses (students' check of both their own answers and their friends' answers) was an evaluation activity. The evaluation activities accorded with Wilson's (2016) statement, evaluating is justifying a decision or course of action, checking, hypothesising, critiquing, experimenting, and judging. The students evaluated the results of the analysis because there were differences in the results.

Decision-making process in directing students to find the right solution

The subject made decisions in directing students to find the right answers. Table 9. presents S1 and S2 interview excerpts to reveal the decision-making process in directing students to find the answers.

Table 9. Decision-making process in directing students to find the right solution

S1	S2
Generating Ideas	
S1 generate his idea in learning 1 about how students could problem-solve correctly, S1 said "*I had several choices: namely, not giving the students additional questions or giving them some additional questions*." For learning 2, S1 said "*I had 2 ways in directing students to find the right solution, giving additional question or no*."	S2 generate her idea in directing students to find problem solutions in learning 1. S2 said "*the strategy found by the students is a new strategy as they have never worked on the problem*." For learning 2, S2 said "*students can use several strategies according to their previous knowledge*."
Clarifying Ideas	
S1 clarify the chosen idea in learning 1. S1 said "*If I gave additional questions, the students would develop their thinking skills so that they could develop new ideas for finding solutions in the appropriate time span. If the students did not get additional questions, they would take a long time to find new ideas for solving problems*." For learning 2, S1 said "*I gave additional question for students to develop student thinking skill, to found new strategy in solving the problem*."	S2 clarify her idea in directing students to find problem solutions in learning 1. S2 said "*students can use several solution strategies for example by using the concept of functions, line equations graph and arithmetic series which are material that has been learnt*." For learning 2, S2 said "*students can solve the problem by reducing the volume of the tube with the volume of the 3 balls or adding the volume of the tube with the volume of the 3 balls*."
Assessing the Fairness of Ideas	
S1 assessing the fairness of an idea in learning 1. S1 said "*I was believed that by giving the students additional questions could direct them to find new ideas for solving the problems given*." In learning 2, S1 also said "*I give scaffolding like additional question to direct students found the new strategy in problem solving*."	S2 assessing the fairness of an idea in learning 1. S2 said "*I believe the student can found new strategy because I gave students a problem than can be solve by using new strategy that use previous material*. In learning 2, S2 said "*I give problem than can be solve by using previous knowledge, so students can find new ideas to solve the problems*."

When generating ideas about how students could problem-solve correctly, S1 had several choices: namely, not giving the students additional questions or giving them some additional questions. Out of several variations of these ideas, the teacher chose to give some additional questions to the students. S2 generated her idea in directing students to find problem solutions. The strategy found by the students was a new strategy as they had never worked on the problem.

S1 clarified the chosen idea by considering two choices: If he gave additional questions, the students would develop their thinking skills so that they could develop new ideas for finding solutions in the appropriate time span. If the students did not get additional questions, they would take a long time to find new ideas for solving problems. S2 clarified her idea in directing students to find problem solutions. Students could use several solution strategies for example by using the concept of functions, line equations graph and arithmetic series which are material that has been learnt.

In assessing the reasonableness of an idea, S1 was confident that his giving the students additional questions could direct them to find new ideas for solving the problems given. S2 assessing the fairness of an idea. S2 believed the student could find new strategy because she gave students a problem than can be solve by using new strategy that use previous material. Students can practice higher

order thinking skills, including reflective thinking which is a very active and rigorous activity with reference to student knowledge (Kholid, Sa'dijah, Hidayanto, & Permadi, 2020).

The students could use additional questions from the teacher to overcome their misunderstandings and build their understanding (Schoenfeld, 2011; Handayani, Sa'dijah, Sisworo, Sa'diyah, & Anwar, 2020), thus enabling them to generate new ideas in solving problems. Creating entails generating new ideas, products, or ways of viewing things; designing; constructing; planning; producing; and inventing (Anderson & Krathwohl, 2001). The students could find the right solutions to the problem. They could generate new ideas and were also encouraged to produce verbal explanations using language that accorded with mathematical concepts.

The problem the teacher gave was a form of mathematics task-oriented HOTS because the teacher encouraged the students to engage in higher-order thinking activities. He asked the students to solve the problem by analysing it, evaluating it, then creating ideas. In presenting the problem, the teacher gave several questions to facilitate the students' thinking. The teacher's assignment pattern was proven to develop HOTS among the students. The most dominant planning involved in teaching is designing assignments and applying them to learning (Borko et al., 2008; Murtafiah, Sa'dijah, Candra, Susiswo, & As'ari, 2018). Assignments in problem form which were given to students in the classroom create the potential for student learning, but whether the task of achieving student potential succeeds depends on how the teacher applies the task (Stein & Kaufman, 2010; Sa'dijah et al., 2019). The teachers' decision-making is a different activity because it was rarely present in mathematics classes in Indonesia. Teachers with a high level of mathematical knowledge will produce students with higher academic achievements if they do something different in their classes (Hill, Schilling, & Ball, 2004).

CONCLUSION

Our study documents that the participating teachers enacted different processes of making-decision in teaching high-level thinking skills. These included decisions about the questions (problems) given, the teacher's decision to ask the students to solve the problem, the teacher's decision to ask the students to check their problem solution, and the teacher's decision to direct the students to find the right solution.

In the context of giving problems, S1 generated the idea about problems in learning starting from a simple form and S2 generated the idea about problems by modifying a question. In clarifying ideas, S1 chose problems, so that the students could investigate the problems. Meanwhile, S2 opted for the context problem in daily life. In assessing the reasonableness of the idea of the problem, S1 chose the problem because the verification question is an analytical problem (C4) which includes in HOTS. If students can work on the problem, then students will practice to think at a high level. Unlike S1, S2 assessed the fairness problem idea by choosing the problem because by solving the problem, students are encouraged to analyze and ask to use some strategies to get the solution.

In the context of solving the problems. S1 generated the idea by using several alternatives to ask students to work on problems. S2 generated the idea by directing students to analyze the problems. S1

clarified the idea if students think individually about the question or analyze the problems. S2 clarified her idea and ask each student to understand the problem about a tube which was inserted with three balls individually. Afterwards, students had to discuss the possible solution strategies in the groups. In assessing the fairness of the idea, S1 opted for asking students to work individually because he believed that students could solve this problem because it was a development from the previous material. In assessing the fairness of the idea, S2 chose to ask students to work in groups because the students could solve this problem by discussing with others in a group work.

In the context of how students conducted evaluations in the solution of problems. In generating idea, S1 used several choices. S2 also used several strategies to ask students to check the problem solution. S1 clarified the chosen idea by considering two choices. If the students were only asked to evaluate their own answers, then their skills in evaluating would be less than optimal. S2 clarified her idea by asking the students to check the answer of group's solution by comparing the result with other groups', so the students evaluate their solution. In assessing the fairness of the idea, S1 asked students to check the answers because students are also trained to think at a high level that is evaluating in accordance with curriculum demands. S2 asked students to check the answers of group's solution because she trained students to evaluate as a part of higher order thinking skills.

In the context of directing students to find the right solution. S1 generated ideas by employing several choices. S2 generated her idea in directing students to find problem solutions. S1 clarified the chosen idea by considering two choices. S2 clarified her idea by using several solution strategies. In assessing the reasonableness of an idea, S1 was confident that his giving the students additional questions could direct them to find new ideas for solving the problems. Meanwhile, S2 believed the students can find new strategies because she gave them a problem that could be solved by using new strategies in the previous class.

This study suggested that the teacher's decision to engage students in high-level thinking could be used to inspire other teachers who had not taught HOTS to their students. The results could also provide additional information and knowledge to prospective teachers regarding how to teach HOTS to students. In line with the results of this study, future research agenda should develop approaches on how to assess teachers or prospective teachers teaching higher order thinking skills in mathematics classroom.

TEACHING HIGHER ORDER THINKING SKILLS (HOTS) IN MATHEMATICS CLASSROOMS: GENDER DIFFERENCES

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