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Thinking Process Analysis on Curved Shapes Of Field Independent and Field Dependent Cognitive Style for Student's Grade IX-C SMP Negeri 01 Salatiga

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Abstract. The purpose of this research is describe thinking process analysis on curved shapes of field independent (FI) and field dependent's (FD) cognitive style for student grade IX-C SMP Negeri 01 Salatiga. This research is a qualitative research. The subject of this research are student grade IX-C SMP Negeri 01 Salatiga. Data collection methods are GEFT Test, essay test, depth interviews, and observation. The analysis techniques are the data reduction, data display and conclusion. Based on GEFT Test, we get 78% of students have FI cognitive style and 22% students have FD cognitive style. For each cognitive style, we take 3 students so the subject of this research consists 6 students' roommates 3 FI students have cognitive style and 3 students have DF cognitive style. The result of this research are student who have cognitive style FI growing niche use conceptual thinking process and student who have FD cognitive style growing niche use semi-conceptual thinking process.
Keywords: thinking process, cognitive style, independent field, field dependent

INTRODUCTION

Mathematics is one of the subjects taught at every level of education, from primary school to high school. Mathematics is a discipline that has typical properties when compared with other disciplines, because of mathematical knowledge cannot be moved completely from teacher to student in absorbing the lessons [1]. In learning mathematics, students must know and understand the mathematical objects. Ruseffendi stated that the object is directly related to mathematics learning activities includes facts, skills, concepts, and rules / principles [2]. Students cannot understand the math only by memorizing formulas, but deeply understanding, comprehending and have good skill are needed.

Geometry is one of the branches in mathematics. Geometry occupies a special position in school mathematics curriculum, seeing that many concepts contained therein and its application in everyday life [3]. Students are required to master geometry in junior high school according to the standard contents include basic competence of the context between the lines, angles (draw and split corners), a triangle including draw triangles, and rectangles, Pythagoras theorem, circle (tangent ally, the outer circle, and inner circle of triangle and draw it), cubes, cuboid, prism, pyramid, and its nets, similarity and congruence, tubes, cones, balls, and use them in problem solving.

In learning geometry, students are required a solid concept to be able to apply the skills in geometry such as visualizing, identifying assortment of plane and solid figures, describing pictures, drawing plane and solid figure, labeling a certain point, and the ability to recognize the differences and similarities between the geometry figures. Moreover, in solving geometry problems require a mindset in applying concepts and ability in solving the problem. Basically geometry has a greater opportunity to be understood by students compared to other branches of mathematics. This is because the ideas of geometry already known by students before they enter the school, for example, line, plane and solid. Geometry material that students often find in their daily life should be easily understood. The geometry around students should be understood easily. In fact, some students are still experiencing difficulties in learning and solving problems of geometry. Difficulties students have in mathematics, especially geometry needs to be addressed as early as possible, because math is an important subject for students to develop the capabilities and help solving problems in everyday life [4]. In solving math problems, it is found that there are some students who demonstrate very well, there are students who demonstrate average, and there are students who face difficulties [5]. The cause of dissimilarity of students'

solving problems ability is students tend to have various thinking processes from one student to another. In addition to a various thinking process, students, in the approach to the learning situation, receive, organize and connect different learning experiences. Teaching geometry trains the students to think logically; therefore geometry arises and grows as the thinking process [1].

The thinking process is a sequence of mental events that occur naturally or planned and systematic way in the context of space, time and media used, and produces a change objects that influence it. The thinking process is an event mix, match, merge, exchange, and sort concepts, perceptions, and previous experience [6]. The thinking process is a process that begins by receiving data, processing and storing it in memory and then gets it back from memory when needed for further treatment [7].

The thinking process is divided into three kinds, which are conceptual thinking process, the semi-conceptual thinking process, and computational thinking process [8]. The process of conceptual thinking is a way of thinking that always solves the problem by using a concept that has been owned based on the results of the assessment. Semi-conceptual thinking process is a process of thinking in solving problems tends to use the concept but lack of understanding the concept so the solution is mixed with solving process that uses intuition. The process of computational thinking is a way of thinking that is generally in resolving the problems by relying on intuition. Some indicators to explore each thinking process as follows 1) The process of conceptual thinking is capable of stating what is known in the problems itself, able to state in their own sentence, in solving problems, students tend to use a concept that has been studied, and able to mention elements of the concept which was completed; 2) In semi-conceptual thinking process, students are lack to identify what is known in the problem, lack to state what is known in the problem using students' own sentence, tend to use the concept that has been studied, although it is incomplete, unable to explain the steps being taken, and 3) In computational thinking process, students can not state what is known in the problems by their own sentence, unable to state with own sentence about what is asked the question, in answering, students tend to miss the concept that has been studied and unable to explain the steps.

The differences of thinking process that each student has can be expressed in the cognitive types, which are known as cognitive style. Cognitive style is the way of a person to process, store and use the information to respond a task or various environmental situations. Psychology experts and education suggested two cognitive styles, which are Field Dependent (FD) and Field Independent (FI) cognitive style. Field dependent cognitive style is a cognitive style that owned by the students to receive something more global and to encounter difficulty in seceding from the environment or being influenced by the environment [9]. While Field Independent cognitive style is the cognitive style of the students most likely to describe a loose background overview of the picture, and be able to distinguish objects around. The fundamental dissimilarity of both cognitive styles lies on the standpoint of the problem. Based on several studies in psychological field, it is found that individuals with Field Independent cognitive styles tend to be more analytical in facing a problem compared to individuals with Field Dependent cognitive style [5]. Students with Field Dependent cognitive style are stronger in recalling information or conversations between individuals, it is easier to learn history, literature, language, and social studies, while students with Field Independent cognitive styles would be easier to decipher things which are complex and easy to solve problems, to study about natural science and mathematics [11].

Based on the background above, it can be defined objectives of this research are as follows: 1) Determine the thinking process on three-dimensional curved face with Field Independent (FI) cognitive style for students of IX in SMP Negeri 1 Salatiga. 2) Determine the thinking process on curved-face three-dimensional objects with Field Dependent (FD) cognitive style for students of IX in SMP Negeri 1 Salatiga.

RESEARCH METHODOLOGY

This type of research is qualitative research. The result of the data is descriptive data in the form of sentences, words or pictures. Information obtained through observation, testing and interview. Subjects in this research were 6 subjects consisted of 3 subjects with FI cognitive style and 3 subjects with FD cognitive style. The subjects was obtained by using GEFT test. Data analysis techniques in this research, according to Miles and Huberman [11] included data reduction, data display, and data conclusion. Research instruments were divided into two, which are cognitive style analysis instruments of FI and FD, in the form of GEFT test consisting of 18 questions. GEFT test is sets of psychomotor tests were designed to determine the cognitive style of the students. Students are given a score of 1 if the answer is correct and 0 if the answer is incorrect. The lowest score in GEFT test is 0 and the highest score is 18. Students who can answer correctly at least nine questions had cognitive style of Field Independent and students who can answer less than nine questions had cognitive style of Field Dependent. GEFT assess the ability of the subject of research by identifying a simple form that is in a complicated pattern. The test results of GEFT can be determined whether the subject has Field

Independent or Field Independent cognitive style.

The second instrument is the analytical instruments of thinking process in the form three-dimensional curved face test that consists of 5 questions text.

TABLE 1. Test Instruments of Thinking Processes

Standard Competency: 2. Understanding the features of the cylinders, cones and sphere as well as determining its size.			
Basic Competence	Indicators	Question Criteria	No.
1.2 Find the area and volume of cylinder, cone and sphere **1.3** Solve the problems associated with cylinders, cone and sphere	1. Using the formula to calculate the area and volume in solving problems related to three-dimensional curved face	a. Comparing lateral area of the cylinder with lateral area of the sphere, if the sphere is in the cylinder and touch the face of the base, the upper side and blankets tube.	1
		b. Find the surface area of the bullets formed from hemisphere, cylinders, and cones.	2
		c. Find the volume of a cube, if the surface area of the sphere inside the cube is stated.	3
		d. Find the volume of water in a tin in a form of cylinder with the thickness of the faces.	4
		e. Find the remaining water inside the cylinder when three identical solid spheres are inserted and the touch the face of the cylinder.	5

Indicators to explore each thinking process [12] is as follows.

TABLE 2. Indicators for Tracing Each Thinking Process

Conceptual Thinking Process	Semi-Conceptual Thinking Process	Computational Thinking Process
1. Be able to state what is found in the problem with students' own sentence or by changing it into math sentence. 2. Be able to state what is asked in the problem in students' own sentence or by changing it into math sentence. 3. Make a plan to solve the problem completely. 4. Be able to state steps to solve problems using the concept taught. 5. Be able to fix the answers.	1. Lack of the ability to state what is found in the problem with own sentence or by changing it into math sentence. 2. Lack of the ability to state what is asked in the problem in students' own sentence or by changing it into math sentence. 3. Make a plan to solve the problem incompletely. 4. Lack of the ability to state the steps in order to solve the problem using the concept taught. 5. Lack of the ability to correct the errors.	1. Unable to state what is found in the problem with own sentence or by changing it into math sentence. 2. Unable to state what is asked in the problem in students' own sentence or by changing it into math sentence 3. Do not make solving plan. 4. Unable to state the steps in order to solve problems using the concept taught. 5. Unable to correct the errors.

RESULT

The experiment was conducted in SMP Negeri 1 Salatiga. Subjects were in class IX C SMP Negeri 1 Salatiga. The first test was GEFT test participated by all subjects or the entire students of IX C. Further test results were analyzed to obtain subjects with Field Independent (FI) and Field Dependent (FD) cognitive style. Subjects with FI cognitive styles can answer GEFT test correctly scored above 9 of 18 problems while the subjects with FD cognitive style is subjects who can answer correctly GEFT test scored under 9 of 18 problems.

After classifying subject with FI and FD cognitive styles, then 3 subjects with FI cognitive styles and 3 subjects with FD cognitive style are taken. FI cognitive styles subjects tend to simply elaborate complex problems and easily learn science and mathematics. Whereas the subjects with FD cognitive style are stronger in

recalling information or a personal conversation and the subjects are easier to learn history, literature and the social studies. The subject will participate in the next test, which is a thinking process test about three-dimensional curved face and will participate in an interview related to thinking process test. To participate in the next test, 3 FI subjects and 3 FD subjects are chosen through researchers consideration which are the subject has already learned three-dimensional curved face and through consultation with math teachers of IX C, where that teachers are more familiar with the character even the ability of the subject.

Analysis of the thinking process is obtained through the three-dimensional curved face test that consists of 5 essays in the form of question text. Thinking process test is not only on the written test but also followed by individual interviews in order to find out the thinking process of students in solving three-dimensional curved face test. Based on the results of written tests and interviews conducted on 6 subjects consisted of 3 FI subjects and 3 FD subjects, it can be analyzed the results of the thinking process. Here are the results of thinking process analysis of the subject on each question.

Subject FI

Analysis Question 1, which shows the lateral area of the cylinder, is equal to lateral area of the sphere.

FI 1

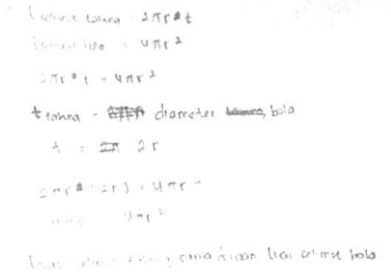


FIGURE 1. FI 1 Results for Problem No. 1

FI subject 1 is able to state what is known in the problem that the sphere inside the cylinder touching the faces of the cylinder so that the height is equal to the diameter of the sphere and asked precisely. The plan of the subject in solving problems is to find the lateral area of cylinder and lateral area of sphere by equaling way around. The subject then change the value of t on the cylinder with 2r, so finding the same formula which is $4\pi r^2$

FI 2

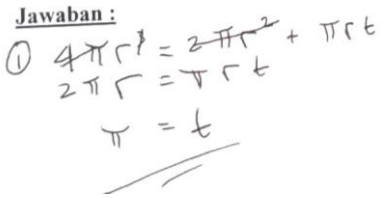


FIGURE 2. FI 2 Results for Problem No. 1

FI subject 2 is able to state what is known that the sphere inside the cylinder touching the faces of the cylinder so the height of cylinder is equal to the sphere diameter and asked in the problem. Subjects are able to plan a problem solving which comparing lateral area of sphere and cylinder, but the subject made mistake in using the formula where the lateral area of sphere = 4πr and lateral area of cylinder = surface area of the cylinder. Subject can state any error in the answer.

FI 3

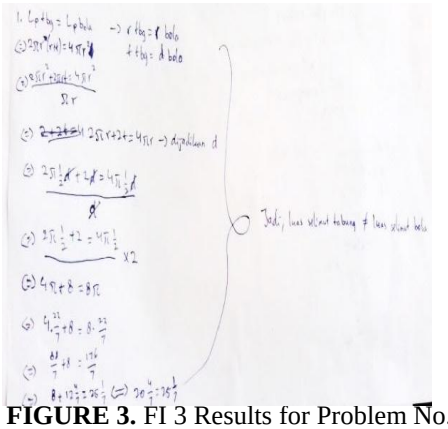


FIGURE 3. FI 3 Results for Problem No. 1

FI subject 3 is able to state what is known in the problem, the subject understands that height of cylinder = diameter of the sphere. Subject plans to solving the problem by stating surface area of the cylinder = surface area of the sphere, it should be lateral area of sphere and cylinder. However, the subject realizes his mistake and changes to lateral surface area of cylinder = lateral surface area of sphere that obtained $2\pi rt = 4\pi r^2$. Subject substitutes d to the formula of lateral surface area of cylinder that obtained $2\pi rd$, and replace r of lateral surface area of sphere with d so that it becomes $2\pi d2$.

Based on the explanation above, it can be concluded that the FI 1, FI 2 and FI 3 in solving problem 1 has conceptual thinking process where the FI subject 1 meets 5 indicators of the thinking process, FI subject 2 meets 3 indicators of the thinking process and FI 3 meets 3 indicators the thinking process.

Analysis of Question 2 is to calculate the surface area of the bullets formed from hemisphere, cylinder and cones.

FI 1

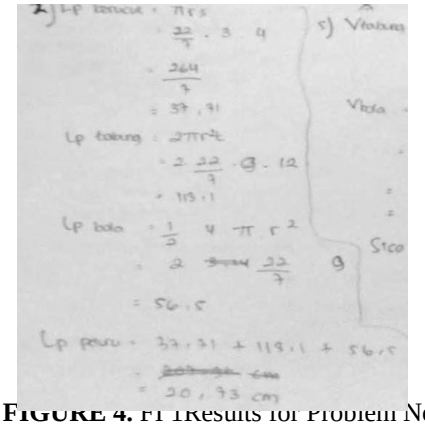


FIGURE 4. FI 1Results for Problem No. 2

Subject is able to state what is known and questioned in the problem, and also able to make a plan to solve the problem precisely by calculating lateral surface area of the cone, cylinder, and hemisphere area. In the interview, subjects mentioned correct formula but the steps in solving the problem are not quite right. Subjects can correct answers.

FI 2

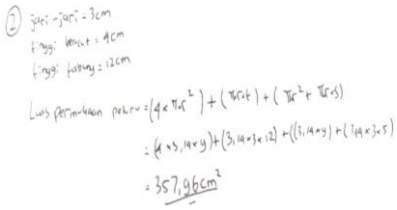


FIGURE 5. FI 2 Results for Problem No. 2

Subject is able to state what is known in the problem and understand the problem well, the subject can make a proper plan in solving problem by calculating the lateral surface area of cone, cylinder and hemisphere area, but steps are not quite right, that is because the subject is mistaken the formula on lateral surface area of cone. The subject can correct the error.

FI 3

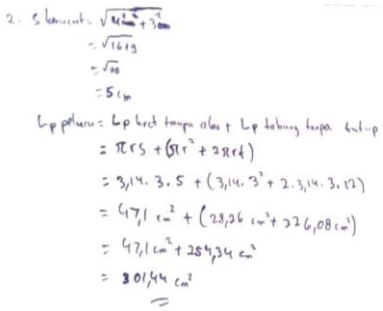


FIGURE 6. FI 3 Results for Problem No. 2

Subject is able to state what is known in the problem and understand the problem itself, the subject is less able to plan proper solving problem where the subject mentioned lateral surface of cone, the surface area of the opened cylinder and miss the formula for the area of hemisphere. Subject is able to correct the answer and realize that the formula used is not proper yet and miss the formula of the hemisphere area.

Based on the explanation above, it can be concluded that the FI 1, FI 2 and FI 3 in solving problem number 2 have conceptual thinking process where the subject FI 1 meets four indicators of the thinking process, subject FI 2 meets three indicators of the thinking process and FI 3 meets four indicators the thinking process.

Analysis Question 3 is to calculate the volume of a cube if the surface area of the sphere inside the cylinder is known.

FI 1

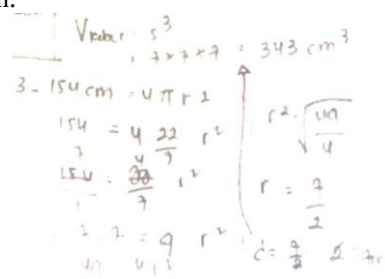


FIGURE 7. FI 1Results for Problem No. 3

Subject is able to state what is known in the problem. Subject understands that the diameter of sphere equals to the length of the face of the cube. The plan subject make to solve the problem is to calculate the radius using the surface area of sphere. Subject finds the results r = 7/2 cm. The subject then calculates the volume of a cube and gets 343 cm3.

FI 2

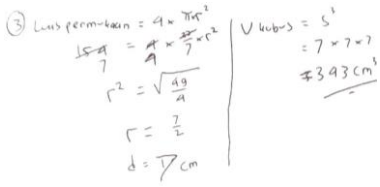


FIGURE 8. FI 2Results for Problem No. 3

Subject is able to state what is known and questioned in the problem, subject understands that the length face of the cube equals to the diameter of the sphere. Subject also makes proper plan of solving problem which the subject calculates the radius using the formula of sphere surface area so as the result is r = 7/2 and then calculate the volume of a cube s x s x s, and the result is 343 cm^3

FI 3

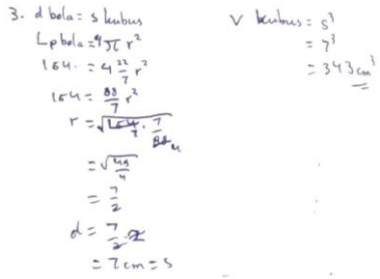


FIGURE 9. FI 3 Results for Problem No. 3

Subject is able to state what is known and questioned in problem correctly. Subject understands that the face of cube is equal to the diameter of the sphere. Subjects also make proper planning where the subject using the formula of the surface area of the sphere to find the radius, which results r = 7/2 cm, the subject then calculate the volume of a cube by writing the formula a x a x a = 7 x 7 x 7 = 343 cm^3

Based on the explanation above, it can be concluded that the FI 1, FI 2 and FI 3 have conceptual thinking process in solving the problem, where the subject FI 1 meets 5 indicators of thinking process, subject FI 2 meets 5 indicators of thinking process and FI 3 meets 5 indicators of thinking process.

Analysis Question 4 is to calculate the volume of water of cylinder in the form of a can that has face thickness.

FI 1

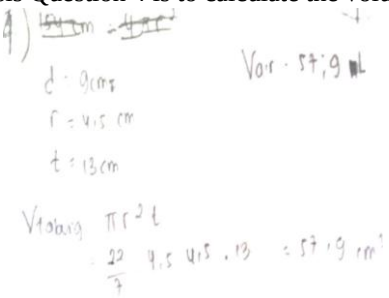


FIGURE 10. FI 1 Results for Problem No. 4

Subject is able to state what is known in the problem where the subject understands that the thickness of the can will affect the size. Subject also states what is asked in the problem correctly. In solving the problem, subject calculates the volume of a cylinder = $\pi r^2 t$. Where the radius is 4.5 cm, and the height is 13 cm because it is subtracted from the thickness. However, the subject seems inaccurate in calculating, later after checking and recalculating, the subject realizes his mistake and able to fix it.

FI 2

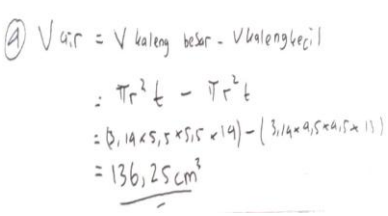


FIGURE 11. FI 2 Results for Problem No. 4

Subject lacks in stating what is known and asked in the problem. Subject, in planning the solution, is not exactly right where the subject calculates the volume of a large cylinder – the volume of a small cylinder. Since the planning of solving problem is incorrect, so the next steps are considered incorrect. However, the subject can fix the problem by calculating the volume of a cylinder inside and realize that its thickness cannot be filled with water.

FI 3

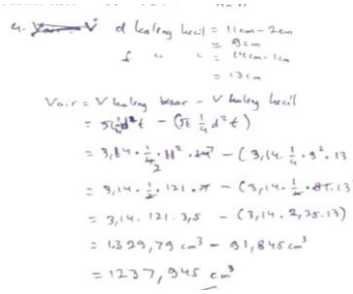


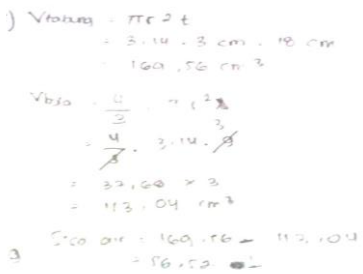
FIGURE 12. FI 3 Results for Problem No. 4

Subject is able to state what is known and asked in the problem; subject understands that the thickness of can influences the size. Yet in planning, subject makes improper solving problem where the subject calculate the volume of large can - small can volume so that the next steps are wrong. The subject then can correct the answer when interview process, the subject constructs a new plan where the subject calculates the volume inside.

Based on the explanation above, it can be concluded that the FI 1, FI 2 and FI 3 in solving number 4 have conceptual and semi-conceptual thinking process where the FI subject 1 has conceptual thinking process as it fulfills the four indicators of conceptual thinking process, FI subject 2 has a semi-conceptual thinking process due to meet four indicators of semi-conceptual thinking process and FI 3 has conceptual thinking process that meets three indicators conceptual thinking process.

Analysis of Question 5 is to calculate the remaining water in the cylinder if three identical solid spheres are inserted and touching the face of cylinder.

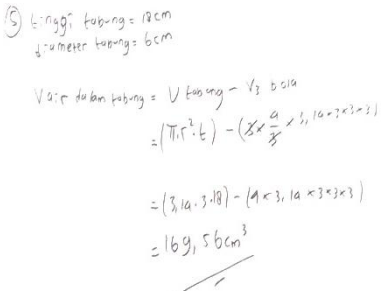
FI 1



Subject is able to state what is known and asked the problem. Subject can make a plan for solving problem by calculating the volume of a cylinder subtracted 3 volumes of a sphere, but the subject makes mistake in writing the formula of sphere volume. Subjects also experienced an error in multiplication for being inaccurate. Subject is able to fix the error by recalculating the answer and write down the sphere volume formula 4/3 πr^3.

FIGURE 13. FI 1 Results for Problem No. 5

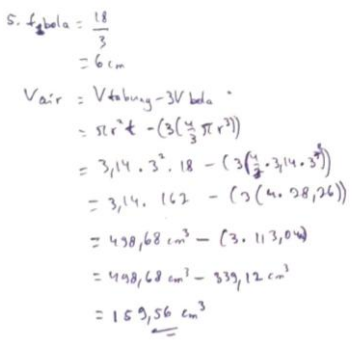
FI 2



Subject is able to state what is known and asked in the problem number 5. Subject is able to make proper planning by calculating the volume of a cylinder and is subtracted by 3 sphere volume using proper steps and obtaining the correct answer.

FIGURE 14. FI 2 Results for Problem No. 5

FI 3



Subject is able to state what is known and asked in the problem correctly. The subject also can make proper planning where the subject subtracts volume of cylinder to 3 volume of a sphere. In interview process, subject recalculates and the result of cylinder volume is = 508.68 and the subject realizes the errors in the answer.

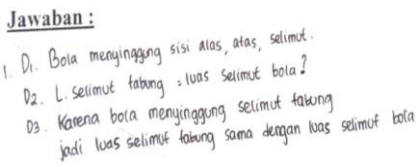
FIGURE 15. FI 3 Results for Problem No. 5

Based on the explanation above, it can be concluded that the FI 1, FI 2 and FI 3 in solving number 5 has conceptual and semi-conceptual thinking process where the subject FI 1 has conceptual thinking process because it meets the three indicators of the conceptual thinking process, the FI subject 2 has a conceptual thinking process because it meets the 5 indicators conceptual of thinking process and FI 3 has conceptual thinking process which meets the 5 indicators of conceptual thinking process.

Subject FD

Analysis Question 1 shows the lateral surface area of cylinder and sphere.

FD1



Subject is unable to state what is known and asked in the problem. Subject is confused when asked about the planning of problem solving, and the answer is sphere touches the lateral surface of the cylinder. When the student is asked to show the solution in a mathematic way, subjects answered using the formula of cylinder and sphere lateral surface. The subject is confused and does not understand. The subject also cannot fix the

FIGURE 16. FD 1 Results to Problem No. 1

answer.

2FD

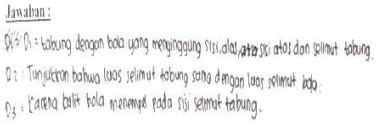


FIGURE 17. FD 2 Results for Problem No. 1

Subject is unable to state what is known and asked in the problem. Subject cannot make plans for the problem solving since the subject only answers the face of the base, top, and lateral surface of cylinder touching the sphere, thus lateral surface of cylinder is equal to lateral surface of sphere. When asked to solve it in math process, subject did not know the answer and felt confused. The subject is also not able to fix the answer.

FD 3

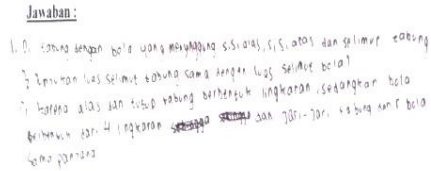


FIGURE 18. FD 3Results for Problem No. 1

Subject is unable to state what is known in the problem, where the subject states that sphere touches the face of the cylinder. Subjects can mention what is known. Yet the subject cannot make plans in the problem stating that the cylinder has a circular base and top and a sphere is formed of four circles then both areas are equally large. When asked to solve it in math process, the subject wrote the formula of cylinder and sphere lateral surface; subject cannot continue.

Based on the explanation above, it can be concluded that the FD 1, FD 2 and FD 3 in solving number 1 have computational thinking process where the FD subject 1 has the computational thinking process because it meets the 3 indicators of the process of computational thinking, FD subject 2 has the computational thinking for meets 3 indicators of computational thinking process and FD 3 has the computational thinking processes that meets 3 indicators of computational thinking process.

Analysis of Question 2, to calculate the surface area of the bullets formed from hemisphere, cylinder, and cones

FD 1

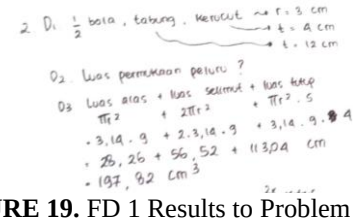


FIGURE 19. FD 1 Results to Problem No. 2

Subject is able to state what is known and asked in the problem. Subjects are less able to make a proper plan in problem solving, where the subject calculates the area of a cone, cylinder, and sphere. When asked why the subject calculated the surface area, the subject did not know. The subject is confused when asked to show the mistake.

FD 2

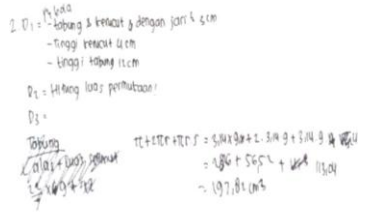


FIGURE 20. FD 2 Results for Problem No. 2

Subject is able to state what is known and asked in the problem. Solving problem planning of Question 2 is by calculating the surface area of the cone, cylinder, and sphere. Subjects did not calculate the length of the line, but consider that the height of the cone is *s*. Subject is confused when continued to solve the problem and the subject cannot fix answer.

FD 3

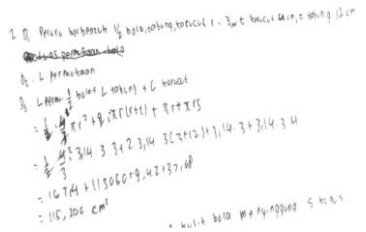


FIGURE 21. FD 3 Results for Problem No. 2

Subject is able to state what is known and asked in the problem correctly. Subject problem-solving plan is to calculate the surface area of the cone, the surface area of the cylinder, and the surface area of the hemisphere. Subject writes incorrect formulas in which the surface area of sphere is $4/3\pi r^2$ and the surface area of cone is π+r πrs. When asked whether the subject is already sure about the answer, the plan, and the steps, subject is still sure that the answers are correct.

Based on the explanation above, it can be concluded that the FD 1, FD 2 and FD 3 in solving problem 2 has semi-conceptual thinking process that and it is unclassified, in which the subject FD 1 has semi-conceptual thinking process because it meets 3 indicators of semi-conceptual thinking process, subject FD 2 has semi-

conceptual thinking process because it 3 indicators of the thinking process. The thinking process of FD subject 3 cannot be classified as the subject meets 2 indicators of computational thinking process, 2 indicators of semi-conceptual thinking process, and 1 indicator of computational.

Analysis Question 3 is to calculate the volume of a cube if the surface area of the sphere inside the cylinder is known.

FD 1

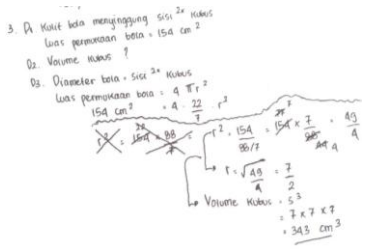


FIGURE 22. FD 1 Results to Problem No. 3

Subject is able to state what is known and asked in the problem. Subject is less able to make a problem-solving plan that the subject stated the sphere skin is equal to the diameter of the cube. Subjects can determine the value of *r* through the formula of surface area of sphere that is 7/2 cm. Subject substituted 7 into the formula of cube volume, when asked why the *s* is 7, the subject answered that the number 7 is greater, the subject cannot fix the answer and is confused.

FD 2

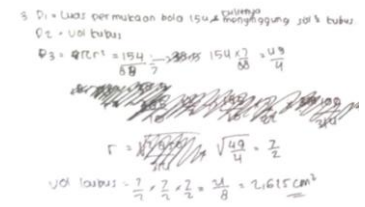


FIGURE 23. FD 2 Results for Problem No. 3

Subject is able to state what is known and asked in the problem. Subject problem-solving plan is by calculating *r* first with the surface area of the sphere formula and the result is *r* = 7/2 cm. However, when calculated the volume of the cube, subject wrote the length of the face = radius. Subject is unable to fix answer because the subjects answered the mistake on the length of the face hesitatingly.

FD 3

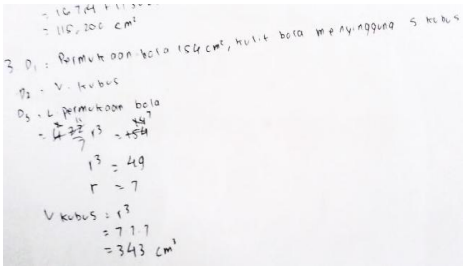


FIGURE 24. FD 3 Results for Problem No. 3

Subject can state what is known and questioned in the problem. The problem-solving plan of the subject is still less proper where the subject writes the cube is r^3. Subject finds the value of *r* with formula of surface area of the sphere but the answer is *r* = 7 cm. When the subject is asked why is that so, the subject is confused and could not find mistake.

According to the analysis above, it can be concluded that FD 1, FD 2 and FD 3 in solving problem number 3, each subject has semi-conceptual thinking process where FD Subject 1 has met 3 indicators of semi-conceptual thinking process. FD subject 2 has semi-conceptual thinking process that meets its 3 indicators and FD subject 3 meets 3 indicators of semi-conceptual thinking process.

Analysis question number 4 is to calculate water volume of a can in the form of cylinder that has face thickness.

FD 1

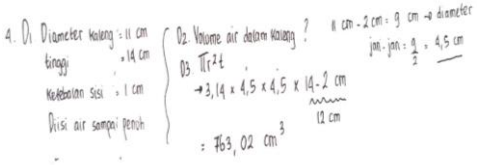
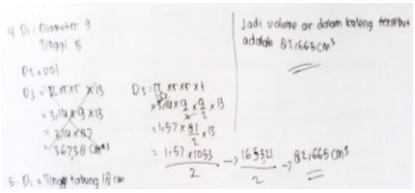


FIGURE 25. FD 1 Results for Problem No. 3

Subject states what is known and questioned in the problem. Subject conceives that the size should be subtracted first with its thickness. However, in the interview process, the subject wrote the formula of cylinder volume 1/3 $\pi r^2 t$. Substitute the value of *r* = 5,5 and length (t) = 12 cm, for the diameter is 11. The subject then calculated 5,5 square = 11 cm. Subject cannot fix the incorrect answer, and stated that the incorrect answer is the *r* supposed to be 5,5 not 4,5 whereas the *r* is correct 4,5 and the incorrect answer is *t* which is supposed to be 13 cm.

FD 2



Subject is able to state what is known and questioned in the problem. Subject understands that to estimate water volume, the subject should subtract the length of the size with its thickness. Problem-solving plan of the subject is to write cylinder volume formula and substitute *r* = 9/2 cm, length (*t*) = 13 cm that the result

FIGURE 26. FD 2 Results of Problem no. 4

is 826,65 cm^3. Subject is able to fix the mistake on calculating of point (,).

FD 3

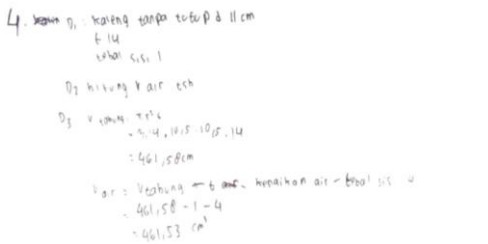


FIGURE 27. FD 3 Results of Problem No. 4

Subject cannot state what is known in the problem where the subject states that there is the increasing of the water in the can. Subject is able to state what is questioned in the problem. Problem-solving plan of the subject is not exactly right in estimating the cylinder volume and subtracted by water increasing. When the subject is asked where water increasing is obtained, the subject answered the sum of face thickness which is 5 cm. subject cannot fix the mistake, and only state the subject miscalculated but could not show the mistake.

According to the analysis above, it can be concluded that FD 1, FD 2, and FD 3 in solving problem number 4, each subject has conceptual and semi-conceptual thinking process where FD subject 1 meets 3 indicators of semi-conceptual thinking process, FD subject 2 meets 5 indicators of conceptual thinking process, and FD 3 meets 3 indicators of semi-conceptual thinking process.

Analysis question number 5 is to estimate the remaining water in the cylinder if 3 identical solid sphere touching the face of the cylinder.

FD 1

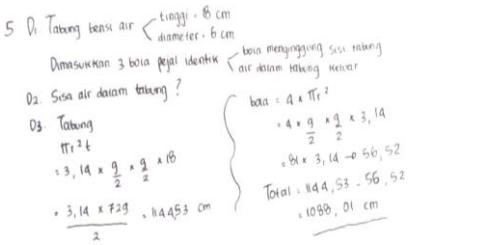


FIGURE 28. FD 1 Results of Problem No. 5

Subject is able to state what is known and questioned in the problem. The subject does not make problem-solving plan correctly where subject calculates the cylinder volume and subtracted by surface area of sphere; subject does not realize that different unit cannot be subtracted. When the subject is questioned, the subject is confused and questioned about the mistake, the student does not know.

FD 2

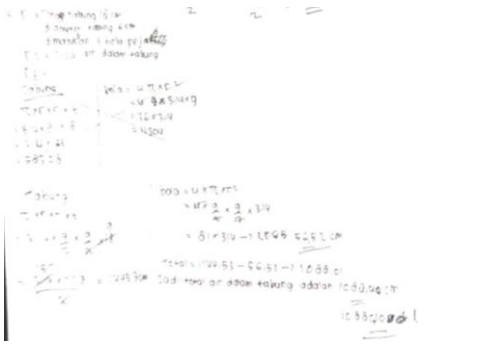


FIGURE 29. FD 2 Result for problem no. 5

Subject is able to state what is known and questioned in the problem. Subject is not able to make problem-solving plan correctly in solving number 5. Subject estimates that the remaining water in the cylinder by calculating cylinder volume subtracted by lateral surface of cylinder. Subject rereads the problem and still with the same answer. Subject could not fix the problem; the subject is confused and does not know.

FD 3

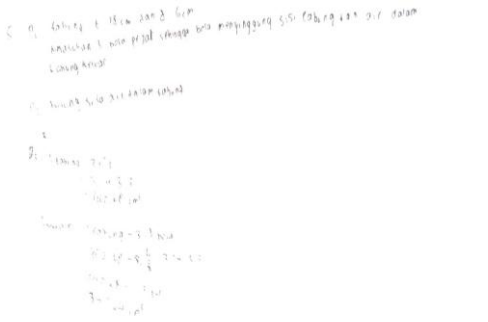


FIGURE 30. FD 3 Results of Problem No.

Subject is able to state what is known and questioned in the problem. Subject makes problem-solving plan incompletely where the subject does not write the formula of sphere volume. Steps the subject taken in solving the problem inaccurately done where the subject does not substitute the height and only multiply the diameter twice on the volume of sphere. Subject fixes the answer incompletely which the mistake is on the height of the cylinder that the value yet changed. However, the subject does not state that the calculation of sphere volume is also incorrect.

5

According to the analysis above, it can be concluded that FD 1, FD 2 and FD 3 in solving problem number 5 has semi-conceptual and computational thinking process where FD 1 subject has computational thinking process that meets 3 indicators of computational thinking process, FD 2 subject has semi-conceptual thinking process that meets 3 indicators of semi-conceptual thinking process, and FD 3 subject has semi-conceptual thinking process that meets 3 indicators of semi-conceptual thinking process.

Thinking Process Analysis each Subject

According to the result of test and interview, it is acquired information about student-thinking process on each cognitive style students have. The following is the data results of student thinking process analysis.

TABLE 3. Results of Student Thinking Process Analysis

No.	Indicator	FI 1	FI 2	FI 3	FD 1	FD 2	FD 3
1	Show lateral surface area of cylinder is equal to lateral surface area of sphere.	K	K	K	KP	KP	SK
2	Find surface area of bullet in the form of hemisphere, cylinder, and cone.	K	K	SK	SK	SK	-
3	Find volume of the cube, if the surface area of sphere inside the cylinder is known.	K	K	K	SK	SK	SK
4	Find water volume in a can in the form of cylinder that has faces thickness.	K	SK	K	SK	K	SK
5	Find the remaining water inside the cylinder if 3 identical solid sphere touching the face of the cylinder.	K	K	K	KP	SK	SK

INFORMATION :
KP : Komputasional (Computational)
SK : Semikonseptual (Semi-Conceptual)
K : Konseptual (Conceptual)

According to the table above, it can be analyzed that FI subject in solving problem number 1, all subjects have conceptual thinking process that means subject used the concept that has been studied before to solving the problem. FD 1 and FD 2 subjects have computational thinking process in solving problem number 1 whereas FD 3 subject has semi-computational thinking process that means the subject using concept that has been studied, however the subject is not able to understand that concept in solving the problem.

In solving problem, FI 1 and FI 2 subjects have conceptual thinking process however FI 3 subject has semi-conceptual thinking process, which means FI 1 and FI 2 subjects, used concept that has been studied in solving the problem. FI 3 subject used the studied concept but still lack of understanding the concept in solving the problem. FD 1 and FD 2 subjects in solving problem number 2, have semi-conceptual process and FD 3 subject is not able to be classified in thinking process indicator, it means that FD 1 and FD 2 subjects used the studied concept but lack of understanding that concept, whereas FD 3 subject does not meet three indicators.

FI subject in solving problem number 3 has conceptual thinking process, which means that the subject used previous studied concept to solver the problem. While FD subject in solving problem number 3 has semi-conceptual thinking process, which means that the subject used the studied concept but lack of understanding the concept in solving the problem.

FI 1 and FI 3 subject in solving problem number 4 has conceptual thinking process while FI 2 subject has semi-conceptual thinking process, which means that the subject used the studied concept but lack of understanding the concept in solving the problem. FD 1 and FD 3 subjects have semi-conceptual thinking process, while FD 2 subject has the computational thinking process, which means that the subject does not use the previous studied concept but tends to use intuition.

FI subject in solving problem number 3 has conceptual thinking process, which means that the subject used previous studied concept to solve problem. FD 1 subject has computational thinking process and FD 2 and FD 3 subjects have semi-conceptual thinking process, which means that FD 1 subject does not use the previous

studied concept but tends to rely on the intuition whereas FD 2 and FD 3 subjects used the studied concept but lack of understanding that concept in solving the problem.

Based on the finding and the discussion above there is a similarity between this research and Istiqomah (2014) reseach, where the subject with cognitive FD style tended having thinking process which was semi-conceptual, while the subject with cognitive FI was more tended having thinking process which was semi-conceptual and conceptual.

This research is very important by knowing students' cognitif ability, because teacher could know how they think. So that, the teacher can choose which is the correct teaching methode to teach them.

CONCLUSION

According to result of the test and interview, it is found that FI 1 subject has conceptual thinking process, FI 2 subject has conceptual thinking process, and FI 3 has conceptual thinking process, thus that all subjects have Field Independent cognitive style of conceptual thinking process, whereas FD 1 subject has semi-conceptual thinking process, FD 2 subject has semi-conceptual thinking process, and FD 3 subject has semi-conceptual thinking process. Based on that result, it can be concluded that Field Dependent cognitive style subject has semi-conceptual thinking process.

Recommended for future research : the subject of this research was limited only for IX-C students of SMP Negeri 1 Salatiga, so the result was only valid for the subject. The further research is needed in order to obtain result which will valid for wider area, so we recommend for the future researcher to increase the amount of the subject.

REFERENCE

1. Nuraini, Trias. 2008. *Analisis Proses Berpikir Siswa dalam Belajar Geometri Berdasarkan Teori Belajar Van Hiele*. Essay. FKIP Universitas Muhammadiyah Surakarta.
2. Muhassanah, Nur'aini dkk. 2014. Analisis Keterampilan Geometri Siswa dalam Memecahkan Masalah Geometri Berdasarkan Tingkat Berpikir Van Hielle. *Jurnal Elektronik Pembelajaran Matematika vol.2, No 1, hal 54-66, Maret 2014 ISSN : 2339-1685*
3. Yuwono, Ridho Muhammad. 2014. Eksperimentasi Model Pembelajaran Kooperatif Tipe Teams Games Tournament Dengan Strategi Peta Konsep Pada Materi Segiempat Ditinjau Dari Kemampuan Spasial Peserta Didik. *Jurnal Elektronik Pembelajaran Matematika. Vol.2. No.9. ISSN 2339-1685*
4. Eka, Kharisma Maulana. 2012. Proses Berpikir Siswa dalam Menyelesaikan Soal Cerita di SMU Kelas X. Surabaya: FMIPA
5. Ngilawajan, AD 2013. Proses Berpikir Siswa SMA Dalam Memecahkan Masalah Matematika Pada Materi Turunan Ditinjau Dari Gaya Kognitif Field Independent Dan Field Dependent. *Jurnal Pedagogia Vol. 2, No. 1, Februari 2013:halaman 71-83*
6. Kuswana, WS (2013). *Taksonomi Berpikir*. Bandung: PT Remaja Rosdakarya
7. Masfingatin, Titin. 2013. *Proses Berpikir Siswa Sekolah Menengah Pertama dalam Memecahkan Masalah Matematika Ditinjau dari Adversity Quotient.* Thesis. Surakarta :UNS
8. Zuhri, D. 2008. *Proses Berpikir Siswa Kelas II SMP Negeri 16 Pekanbaru dalam Menyelesaikan Soal-soal Perbandingan Senilai dan Perbandingan Berbalik Nilai.* Thesis. Surabaya: UNESA
9. Santia, Ika. 2015. Representasi Siswa SMA dalam Memecahkan Masalah Nilai Optimum Berdasarkan Gaya Kognitif Field Independent dan Field Dependent. *Jurnal Math Educator Nusantara Volume 01 Nomor 01, Mei 2015.*
10. Tiffani, Haqqinna. 2015. *Profil Proses Berpikir Siswa SMP Dalam Menyelesaikan Soal Perbandingan Berdasarkan Gaya Belajar Dan Gaya Kognitif*. Skripsi: Tidak Diterbitkan.
11. Sugiyono. 2012. *Metode Penelitian Kuantitatif, Kualitatif, dan Kombinasi (Mixed Methods).* Bandung : Alfabeta. CV
12. Retna, Milda dkk. 2013. Proses Berpikir Siswa Dalam Menyelesaikan Soal Cerita Ditinjau Berdasarkan Kemampuan Matematika. *Jurnal Pendidikan Matematika STKIPPGRI Sidoarjo Vol. 1, No. 2 September 2013 ISSN: 2337-8166.*