Journal of Namibian Studies, 34(2023): 6906–6921 ISSN: 2197-5523 (online)

Profile of Conceptual Knowledge of Students on Operations to Add and Subtract Algebraic Forms Based on Cognitive Style

Pathuddin[1], Anggraini[2], Mubarik[3], Fajriani[4], Rahma Nasir[5], Widya Astuti[6]

Abstract

This study aims to describe the profile of conceptual knowledge of students in arithmetic operations of addition and subtraction of algebraic forms in terms of cognitive style. This type of research is a qualitative research with a qualitative descriptive approach. The research subjects were 2 students with reflective cognitive style and impulsive cognitive style taken from students of junior high school in Palu. Data analysis went through 3 stages, namely data condensation, data presentation and conclusion drawing. The results showed that: 1) The conceptual knowledge profile of students with a reflective cognitive style includes: a) Category or classification knowledge, which involves students' ability to categorize or classify algebraic forms based on similar terms. b) Knowledge of principles or generalizations, which include students' understanding of the principles or properties of operations in algebraic form. c) Knowledge of theory, models, and structures, which involve students' ability to present addition and subtraction of algebraic forms in mathematical representations or mathematical models, as well as an understanding of the basic elements in interrelated structures. 2) The conceptual knowledge profile of students with an impulsive cognitive style includes: a) Category or classification knowledge, which involves students' ability to classify or categorize algebraic forms based on similar terms. b) Model knowledge, which includes students' ability to present addition and subtraction of algebraic forms in mathematical representations or mathematical models. Thus, this study provides an overview of students' conceptual knowledge profiles in arithmetic operations of addition and subtraction of algebraic forms, which are differentiated based on cognitive style. This information can be the basis for designing learning strategies that suit students' cognitive styles and help improve their understanding of mathematics.

Keywords: Conceptual Knowledge Profile, Operations of Addition and Subtraction of Algebraic Forms, Cognitive Style.

Introduction:

Mathematics is a universal knowledge and underlies the development of science and technology (Muhtadi et al., 2017). The importance of this knowledge makes mathematics one of the subjects studied at every level of education ranging from elementary, junior high, high school to college. Mathematics is knowledge that is inherent in life activities, where every activity cannot be separated from mathematical activities (Nurhasanah et al., 2017); (Prahmana et al., 2012). Mathematics is universal and has characteristics such as abstract objects, logical and deductive thinking patterns, and consists of various symbols that are empty of meaning (Ilma et al., 2020). One of the goals of learning mathematics that is very important is the ability of students in knowledge of mathematical concepts. (Bisson et al., 2016) stated that better conceptual knowledge is the main goal of education intervention and policy change. One of the principles in learning mathematics is that students must learn mathematics with knowledge, and actively build new knowledge based on previous knowledge and experience. Conceptual knowledge is characterized most clearly as knowledge rich in relationships (Groth, 2014). Schneider & Stem (2010) suggested that conceptual knowledge is knowledge that provides an abstract understanding of the principles and relationships between bits of knowledge in a particular domain. This definition reinforces the definition given by (Khashan, 2014) which defines conceptual knowledge as abstract knowledge that discusses the essence of mathematical principles and the relationship between them.

Concept knowledge is very important in learning because by knowing the concept students can develop their abilities in each learning material. Conceptual knowledge is a basis for the case structure that explains and gives meaning to the procedures that have been used (Zakaria et al., 2007; Stienstra, 2014). Furthermore, Isleyen & Isik (2003) describe conceptual knowledge in mathematics as knowledge consisting of symbols and demonstrations. Therefore, it means that this knowledge represents mathematical concepts and connects pieces of mathematical knowledge with each other to provide an understanding of mathematical concepts, rules and propositions (Rech et al., 2017). According to Sahidin, et al. (2019) Conceptual knowledge is rich in relationships and refers to the basic constructions of mathematics and the relationships between ideas that describe mathematical procedures and give meaning. Similarly, Baroody et al. (2007) describe conceptual knowledge as knowledge of concepts and principles and their relationship to one another.

Conceptual knowledge is knowledge of more complex and organized forms of knowledge (Anderson et al. 2001). This means that conceptual knowledge is a network that binds pieces of information into a relatively complete and intact part. Conceptual knowledge, also referred to as conceptual knowledge, requires abstraction and generalization from certain examples (Salifu, 2021). Similarly, Schneider & Stem (2010) describe conceptual knowledge as a type of knowledge that offers an abstract understanding of the principles and relationships between knowledge relationships in an aspect. In other words, conceptual knowledge is knowledge that binds previously separated information into a relatively complete network. This means that conceptual knowledge is a network that binds pieces of information into a relatively complete and intact part.

Conceptual knowledge is knowledge that shows the interrelationships between basic elements in a larger structure and all function together. Conceptual knowledge includes schemas, thought models and theories, both implicit and explicit. There are three kinds of conceptual knowledge, namely (1) knowledge of classification and categories, (2) knowledge of principles and generalizations and (3) knowledge of theories, models and structures (Widodo, 2006). Students with good conceptual knowledge will be able to understand the importance of mathematical ideas and be able to use them in a variety of different contexts. Because this is in line with the opinion of Serhan (2015) which states "Students' conceptual knowledge is developed by the construction of relationships between pieces of information". This means that students' conceptual knowledge is developed by constructing relationships between pieces of information.

Based on the 2013 curriculum, one of the materials studied at the junior high school level is the addition and subtraction of algebraic forms. Students' conceptual knowledge in studying addition and subtraction of algebraic forms lies in the basic concepts and their relation to other mathematical concepts, as prerequisite material for learning algebraic forms so that it can be concluded that students' conceptual knowledge is one of the knowledge that students need to have in studying addition and subtraction. algebraic form. Mastery of the addition and subtraction of algebraic forms also affects the next material because it is an early introduction to the concept of algebraic form operations.

Cognitive style is closely related to how to receive and process all information, especially in learning (Fuady et al. 2019). Reflective cognitive style and impulsive cognitive style were first proposed by Jerome Kagan in 1965. Kagan categorizes children's cognitive style into 2 groups, children with reflective cognitive style and impulsive cognitive style (Riswan et al., 2018). There are two important aspects in measuring this cognitive style, namely: (1) the time used by students to make decisions in solving problems; (2) errors made by students in answering questions (Rozencwajg & Corroyer, 2005). With regard to the first aspect, the measurement of impulsive-reflective cognitive style is based on the amount of time students spend in solving problems, with respect to the second aspect, the measurement is based on the number of errors made by students in solving problems (Lambertus et al., 2019). Reflective and impulsive cognitive styles are cognitive styles that show the tempo or speed of thinking. Warli (2013) said "children who have the characteristics of being quick to answer problems, but are not / less careful, so that the answers tend to be wrong, children like this have an impulsive cognitive style. Children who have the characteristics of being slow in answering problems, but careful / thorough so that the answers tend to be correct, children like this are called reflective cognitive style.

The word profile comes from Italian, profile and profilare which means an outline. Profile according to the Big Indonesian Dictionary (KBBI) is (1) a side view (of people's faces); (2) painting (picture) of people from the side; biographical sketches; (3) cross-section (soil, mountains and so on); (4) graphs or summaries that provide facts about specific matters. Profiling is expected to provide an overview or description of students' conceptual knowledge of the arithmetic addition and subtraction of algebraic forms in terms of reflective and impulsive cognitive styles expressed through words or writing.

Based on this description, the researchers conducted a study with the title "Profile of Conceptual Knowledge of Junior High School Students on Operations to Calculate Addition and Subtraction of Algebraic Forms in View of Cognitive Style".

Method

This type of research is qualitative research. The approach used is a qualitative descriptive approach, which produces descriptive data in the form of words. This study aims to describe the conceptual knowledge of junior high school students on arithmetic operations of addition and subtraction of algebraic forms in terms of reflective and impulsive cognitive styles. The subjects of this study were 2 students with each having a reflective cognitive style and an impulsive cognitive style taken from students of junior high school in Palu. Data collection techniques in this study came from tests and interviews. The initial test given is in the form of MFFT (Matching Familiar Figure Test) which aims to obtain research subjects. After getting the research subject, the subject was given a test of the ability to add and subtract algebraic operations to obtain data about students' conceptual knowledge on algebraic operations in the cognitive domain. Testing the credibility of the data using time triangulation, namely giving the first written test conceptual knowledge questions (T1) and the second conceptual knowledge questions (T2) on the same subject but at different times. After the data is considered credible, the data analyzed in this study is T1 data. In this study, data analysis was carried out by referring to the data analysis proposed by Miles and Huberman (1984) in Sugiyono (2018), which consists of three stages, namely: data reduction, data presentation and conclusion drawing/verification. The indicators of conceptual knowledge in this study are as follows:

1. Knowledge of categories or classifications (the ability to classify or categorize algebraic forms based on similar terms).

2. Knowledge of principles or generalizations (knowledge of principles or properties of operations in algebraic form).

3. Knowledge of theories, models and structures (the ability to present addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of elements in interrelated structures).

Research result

The research subjects selected were 2 people. As for the criteria, 1) one student with a reflective cognitive style is taken from a group of reflective students whose records are the longest and most correct in answering all the questions. One student with an impulsive cognitive style was taken from a group of impulsive students whose notes were the shortest but the most incorrect in answering all the questions. 2) Asking for consideration from the mathematics teacher regarding the determination of the subject, namely students who can express ideas or are able to communicate well when communicating opinions/ideas orally or in writing. Subjects were then given a question of conceptual knowledge and each interviewed twice at different times. The questions given are as follows:

Table 1. Written test I and written test 2

	Written test 1		Written test 2
$T1_1$	Determine the result of the sum $2(x + 2y - xy)$ with $5(2x - 3y + 5xy)$	$T2_1$	Determine the result of the sum $3(2x-4y + 5xy)$ with $2(4x + 3y - 7xy)$
$T1_2$	Determine the result of subtraction $5(2 - 3y^2)$ with $8(1 - 2y^2)$	$T2_2$	Determine the result of subtraction $5(1-2y^2)$ with $5(4-2y^2)$

Research Results on Male Students Reflective Answers on Student Job Results and Interviews Reflective on T1

The following are reflective student answers for $T1_1$

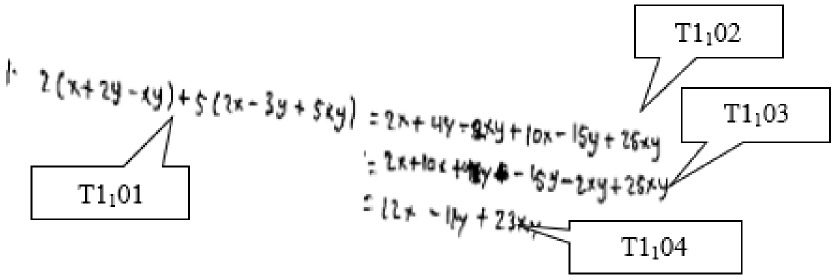


Figure 1. Reflective Student Answers for T11

Based on the answers of the reflective students, it can be seen that the reflective students began to answer the questions into a mathematical model, namely by changing the problem to determine the sum of 2(x + 2y – xy) with 5(2x – 3y + 5xy) Based on the answers of the reflective students, it can be seen that the reflective students began to answer the questions into a mathematical model, namely by changing the problem to determine the sum of 2(x + 2y – xy) with 5(2x – 3y + 5xy) into the form of a mathematical model, namely 2(x). 2(x + 2y – xy) + 5(2x – 3y + 5xy) (TI101). Next, the reflective students did distributive multiplication and wrote 2x + 4y – 2xy + 10x – 15y + 25xy (TI102). Then the reflective students grouped the same variables or similar terms, namely 2x + 10x + 4y – 15y – 2xy + 25xy (TI103) and obtained the sum of similar terms, namely 12x – 11y + 23xy (TI104).

Regarding students' conceptual knowledge, the researcher conducted an interview with BF on June 5, 2021, with a transcript of the results of the reflective student interviews as follows:

Researcher : What if ordered to determine the sum of 2(x+2y – xy) with 5(2x – 3y + 5xy)?

Student: What I know is that you mean 2(x + 2y – xy) + 5(2x – 3y + 5xy)

Researcher : Then what's the next step?

Student: First I multiply 2 × x = 2x, 2 × 2y = 4y, 2 × –xy = –2xy then add 5 × 2x = 10x, 5 × -3y = -15y, 5 × 5xy = 25xy

Researcher : Okay. What's next?

Student: Then it becomes 2x + 4y – 2xy + 10x – 15y + 25xy

Researcher : Okay. Then what's the next step??

Student: Equated with the same tribe

Researcher : Become?

Student: Be 2x + 10x + 4y – 15y – 2xy + 25xy

Researcher : Next, after you put the same type together, what's the next step?

Student: I operate the same kind of 2x + 10x, 4y – 15y, –2xy + 25xy

Researcher : What's next?

Student: Returns 12x – 11y + 23xy.

Based on the results of these interviews, information was obtained that reflective students could understand what the questions were instructed to do by answering the questions into a mathematical model by changing the problem to determine the sum of 2(x + 2y – xy) with 5(2x – 3y + 5xy) into the form of a mathematical model, namely 2(x + 2y – xy) + 5(2x – 3y + 5xy). Next, the reflective students multiply 2 × x = 2x, 2 × 2y = 4y, 2 × –xy = –2xy then add 5 × 2x = 10x, 5 × -3y = -15y, 5 × 5xy = 25xy and write the result is 2x + 4y – 2xy + 10x – 15y + 25xy. Then the reflective students grouped the same variables or similar terms, namely 2x + 10x + 4y – 15y – 2xy + 25xy and the sum of similar terms was 12x – 11y + 23xy. The following are reflective student answers for T12

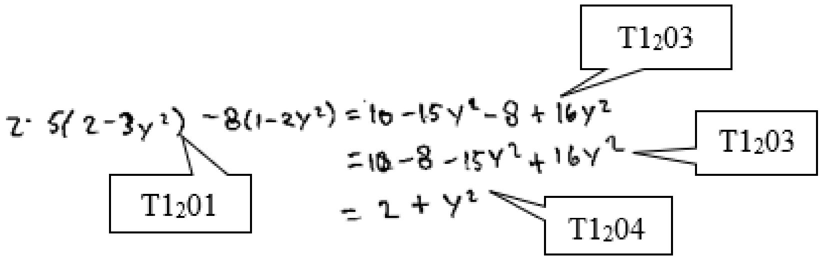


Figure 2. Reflective student answers for T12

Based on the answers of the reflective students, it can be seen that the reflective students began to answer the questions by changing the questions to determine the result of subtraction 5(2 – 3y2) with 8(1 – 2y2) into the form of a mathematical model, namely 5(2 – 3y2) – 8(1 – 2y2) (T1201). Then the reflective students did distributive multiplication and wrote 10 – 15y2 – 8 + 16y2 (T1202). Then the reflective students grouped the same variables or similar terms, namely 10 – 8 – 15y2 + 16y2 (T1203) and obtained the result of subtracting similar terms, namely 2 + y2 (T1204).

Regarding students' conceptual knowledge, the researcher conducted interviews with reflective students on June 5, 2021, with a transcript of the results of the reflective student interviews as follows:

Researcher : What if asked to determine the result of subtracting 5(2 – 3y2) by 8(1 – 2y2)?

Student: The result is 5(2 – 3y2) – 8(1 – 2y2)

Researcher : So what's the next step?

Student: Multiply 5 × 2 = 10, 5 × – 3y2 = – 15y2 Then – 8 × 1 = – 8, – 8 × – 2y2 = 16y2

Researcher : So what's the next step?

Student: Be 10 – 15y2 – 8 + 16y2

Researcher : Okay. The next step?

Student: Then it becomes 10 – 8 – 15y2 + 16y2

Researcher : Next, after you put the same type together, what's the next step?

Student: I operate, 10 – 8, – 15y2 + 16y2

Peneliti : The next step?

Student: The result is 2 + y2

Based on the results of these interviews, information was obtained that reflective students could understand what the questions were instructed to do by answering the questions into a mathematical model by changing the problem, determine the result of subtraction 5(2 – 3y2) with 8(1 – 2y2) into the form of a mathematical model, namely 5(2 – 3y2) – 8(1 – 2y2). Next, the reflective student multiplies 5 × 2 = 10, 5 × – 3y2 = – 15y2 then – 8 × 1 = – 8, – 8 × – 2y2 = 16y2 and writes the result that is 10 – 15y2 – 8 + 16y2. Then the reflective students grouped the same variables or similar terms, namely 10 – 8 – 15y2 + 16y2 and obtained the result of subtracting similar terms, namely 2 + y2. Research Results on Impulsive Student Subjects

1. Student Job Results and Impulsive Interview Answers to T1

Impulsive Student's Answer to T11

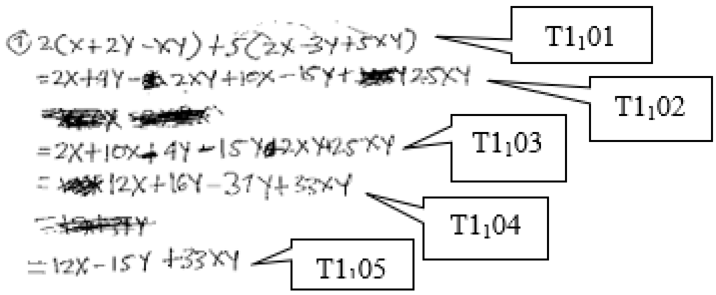


Figure 3. Impulsive Student Answers to T11

Based on the answers of the impulsive students, it can be seen that the impulsive students began to answer questions into the mathematical model, namely by changing the problem, determine the sum of 2(x + 2y – xy) with 5(2x – 3y + 5xy) into the form of a mathematical model, namely 2(x + 2y – xy) + 5(2x – 3y + 5xy) (T1101). Next, the impulsive student did distributive multiplication and wrote 2x + 4y – 2xy + 10x – 15y + 25xy (T1102). Impulsive students group the same variables or similar terms, namely 2x + 10x + 4y – 15y – 2xy + 25xy (T1103). Then the impulsive student wrote 12x + 16y – 31y + 33xy (T1104) and the sum of similar terms was 12x – 15y + 33xy (T1105).

Regarding students' conceptual knowledge, the researcher conducted interviews with impulsive students on June 5, 2021, with the following transcript of the results of the impulsive students' interviews:

Researcher : How about number one? what do you understand from this number one question?

Student: Sum up

Researcher : Which ones?

Student: The number 2(x + 2y – xy) + 5(2x – 3y + 5xy)

Researcher : So what's the next step?

Student: 2 × x = 2x, Then 2 × 2y = 4y, 2 × –xy = –2xy

Researcher : The next step?

Student: Next 5 × 2x = 10x, 5 × –3y = –15y, 5 × 5xy = 25xy (silent)

Researcher : Okay. The next step?

Student: Be 2x + 4y – 2xy + 10x – 15y + 25xy

Researcher : Jadinya 2x + 4y – 2xy + 10x – 15y + 25xy

Student: Next, they are put together into 2x + 10x + 4y – 15y – 2xy + 25xy

Researcher : Next, after you put the same type together, what's the next step?

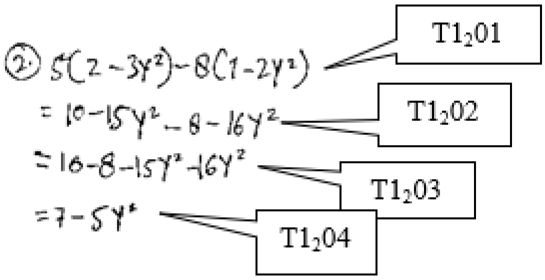
Student: Become 12x + 16y – 31y + 33xy

Researcher : The Next?

Student: So the result is 12x – 15y + 33xy kak

Based on the results of these interviews, information was obtained that impulsive students could understand what the questions were instructed to do by answering the questions into a mathematical model by changing the problem, determine the sum of 2(x + 2y – xy) with 5(2x – 3y + 5xy) into the form of a mathematical model. i.e. 2(x + 2y – xy) + 5(2x – 3y + 5xy). Next, the impulsive student multiplies 2 × x = 2x, then 2 × 2y = 4y, 2 × –xy = –2xy, then 5 × 2x = 10x, 5 × –3y = –15y, 5 × 5xy = 25xy and the result is becomes 2x + 4y – 2xy + 10x – 15y + 25xy. Then the impulsive students group the same variables or similar terms, namely 2x + 10x + 4y – 15y – 2xy + 25xy, hen the impulsive student says it becomes 12x + 16y – 31y + 33xy and gets the result 12x – 15y + 33xy.

Here's the impulsive student's answer to $T1_2$



Picture 4. Impulsive student's answer to T12

Based on the impulsive student's answer, it can be seen that impulsive students begin to answer the question into a mathematical model, namely by changing the question to determine the result of subtraction 5(2 – 3y2) with 8(1 – 2y2) into a mathematical model i.e. 5(2 – 3y2) – 8(1 – 2y2) (T1201). Furthermore impulsive students work on distributive multiplication and write 10 – 15y2 – 8 – 16y2 (T1202). Then impulsive students group the same variables or similar tribes, namely 10 – 8 – 15y2 – 16y2 (T1203) and obtained the result of the reduction of similar tribes, namely 7 – 5y2 (T1204).

Relating to students' conceptual knowledge, researchers conducted an interview with impulsive students on June 5, 2021, with transcripts of impulsive student interview results as follows:

Researchers : Which is reduced?

Student: The numbers 5 (2 – 3y2) – 8 (1 – 2y2)

Researchers : what's the next step?

Student: 5 × 2 = 10, 5 × –3y2 = –15y2, –8 × 1 = –8, –8 × – 2y2 = – 16y2

Researchers : The result?

Student: Remove the brackets to 10 – 15y2 – 8 – 16y2

Researchers : OK. You are at – 8 (1 – 2y2) substraction, right? Is it true that the result is – 8y – 16y2?

Student: The next answer should be 8 – 16y2

Researchers : OK. What is next?

Student: Find the same variables at the end 10 – 8 – 15y2 – 16y2

Researchers : What is next step?

Student: The result is 7 – 5y2.

Based on the results of the interview, information was obtained that impulsive students can understand what the question is instructed by answering the question into a mathematical model by changing the problem determine the result of the reduction 5(2 – 3y2) with 8(1 – 2y2) into the form of a mathematical model i.e. 5(2 – 3y2) – 8(1 – 2y2. Next, impulsive students perform multiplication against 5 × 2 = 10, 5 × –3y2 = –15y2, –8 × 1 = –8, –8 × – 2y2 = – 16y2 and wrote the result i.e.

10 – 15y2 – 8 – 16y2. Then impulsive students group the same variables or similar tribes, namely 10 – 8 – 15y2 – 16y2 and the result of the reduction is obtained, namely 7 – 5y2.

Discussion

Elaborated further on the picture of students' conceptual knowledge based on reflective cognitive styles and impulsive cognitive styles on written tests of the operation of counting addition and subtraction of algebraic forms based on knowledge indicators conceptual according to Widodo (2006), presented in Table 2 as follows:

Table 2. Conceptual knowledge of students based on cognitive style on written tests of the operation of counting the sum and subtraction of algebraic forms

Conceptual Knowledge Indicators	Cognitive Styles	Conceptual Knowledge of Students
Knowledge of categories or classifications (the ability to classify or categorize algebraic forms by similar tribes).	Reflective	1. Students with a reflective cognitive style are able to know knowledge about categories or classifications by grouping the same variables or similar tribes.
	Impulsive	1. Students with impulsive cognitive styles are able to know knowledge about categories or classifications by grouping the same variables or similar tribes.
Knowledge of principles or generalizations (knowledge of the principle or properties of operations in algebraic form).	Reflective	1. Students with a reflective cognitive style are able to understand knowledge of principles or generalizations by performing operations using distributive properties.
	Impulsive	1. Students with impulsive cognitive styles have not been able to perform operations using distributive properties correctly, the results obtained are still wrong and in the results of operating similar tribes, it is seen that the answers given by students with impulsive cognitive styles are not correct.
Knowledge of theories, models and structures (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of elements in	Reflective	1. 1. Students with a reflective cognitive style are able to understand knowledge about theories, models and structures (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of basic elements in interrelated structures) this is shown by shiva with a reflective cognitive style transforming the problem into the form of a mathematical model and knowledge of the structure is shown correctly performing the steps of solving it with a structured manner.

interrelated structures).	Impulsive	1. Students with impulsive cognitive styles can turn problems into the form of mathematical models. On the knowledge of structures, students with impulsive cognitive styles perform settlement steps incorrectly unstructured.

Differences in conceptual knowledge that students have can be caused by one of them because of the differences in cognitive styles that students have. Conceptual knowledge contained in students in this study is 1) Knowledge of categories or classifications (the ability to categorize or classify algebraic forms based on similar tribes); 2) Knowledge of principles or generalizations (knowledge of the principles or properties of operations in algebraic form) and 3) Knowledge of theories, models and structures (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of elements in interrelated structures).

Based on the results of data analysis, information was obtained that in completing T11 and T12 reflective students and impulsive students understand knowledge about categories or classifications (the ability to categorize or classify algebraic forms based on similar tribes), this is indicated by the ability of reflective and impulsive students in answering given questions. The ability to categorize or classify is a form of conceptual knowledge. This is in line with what Gunawan and Palupi (2016) expressed, conceptual knowledge includes knowledge of categories, classifications and relationships between two or more more categories of knowledge that are more complex and organized.

The conceptual knowledge of reflective students is also demonstrated by being able to understand knowledge of principles or generalizations (knowledge of the principles or properties of operations in the form of algebra). This is shown by the ability of reflective students to use the properties of algebraic forms in the matter of counting operations of addition and subtraction of algebraic forms. The ability to understand knowledge of principles or generalizations (knowledge of the principles or properties of operations in the form of algebra) is a form of conceptual knowledge. This is in line with what was expressed by Widodo (2006) conceptual knowledge includes knowledge of principles or generalizations.

Reflective students are also able to understand knowledge of theories, models or structures (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of basic elements in interrelated structures). This is demonstrated by the ability of reflective students to present the addition and subtraction of algebraic forms in the form of mathematical models and perform solving steps in a structured manner. The ability to understand knowledge about theories, models and structures is a form of conceptual knowledge. This is in line with what was revealed by Widodo (2006) there are three kinds of conceptual knowledge, one of which is knowledge of theories, models and structures which includes knowledge of principles and generalizations and the interrelationships between the two that produce clarity to a complex phenomenon.

Impulsive students are able to understand knowledge of models (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models) by presenting the addition and subtraction of algebraic forms in the form of mathematical models, this is shown by the ability of impulsive students in changing a given problem into a mathematical model. This is in line with what was expressed by Claudia (2017) that the ability to represent concepts in various forms, for example presenting in the form of mathematical models is a form of conceptual knowledge.

Based on this discussion, it can be seen that students with a reflective cognitive style have met all the indicators in each conceptual knowledge. This finding is supported by previous findings by Sa'adah, et al (2019) which stated that students' cognitively reflective-style abilities in mathematics learning are able to meet all indicators. Whereas students with impulsive cognitive styles meet only a few indicators of conceptual knowledge.

Conclusion

Based on the results of the research and discussion obtained, it can be concluded that the conceptual knowledge profile of students students on the material of the operation of calculating the addition and subtraction of algebraic forms is viewed from the cognitive style, namely:

1. Profile of conceptual knowledge of students with reflective cognitive styles in solving problems of counting operations of addition and subtraction of algebraic forms in the form of knowledge of categories or classifications (the ability to categorize or classify algebraic forms based on similar tribes), knowledge of principles or generalizations (knowledge of the principles or properties of operations in algebraic form) and knowledge of theories, models or structures (the ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models and knowledge of basic elements in interrelated structures).

2. Profile of conceptual knowledge of students with impulsive cognitive styles in solving problems of counting operations of addition and subtraction of algebraic forms in the form of knowledge of categories or classifications (the ability to categorize or classify algebraic forms based on similar tribes), knowledge of models (the

ability to present the addition and subtraction of algebraic forms in mathematical representations or mathematical models).

Bibliography

Anderson, L. W., Krathwohl Peter W Airasian, D. R., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). Taxonomy for_ Assessing a Revision 0F Bl00M'S Tax0N0My 0F Educati0Nal Objectives. https://www.uky.edu/~rsand1/china2018/texts/Anderson-Krathwohl - A taxonomy for learning teaching and assessing.pdf

Baroody. (2007). An Alternative Reconceptualization of Procedural and Conceptual Knowledge. Journal for Research in Mathematics Education, 3(8), 115–131.

Bisson, M.-J., Gilmore, C., Inglis, M., & Jones, I. (2016). Measuring Conceptual Understanding Using Comparative Judgement. International Journal of Research in Undergraduate Mathematics Education, 2(2), 141–164. https://doi.org/10.1007/s40753-016-0024-3

Claudia, L. F. (2017). Pemahaman Konseptual dan Keterampilan Prosedural Siswa Kelas VIII Melalui Media Flash Player. Seminar Nasional Integrasi Matematika Dan Nilai Islami, 1(1), 26–31. http://conferences.uin-malang.ac.id/index.php/SIMANIS/article/view/28

Fuady, A., Purwanto, -, Susiswo, -, & Rahardjo, S. (2019). Abstraction reflective student in problem solving of Mathematics based cognitive style. International Journal of Humanities and Innovation (IJHI), 2(4), 103–107. https://doi.org/10.33750/ijhi.v2i4.50

Groth, R. E. (2014). Prospective Teachers' Procedural and Conceptual Knowledge of Mean Absolute Deviation. Investigations in Mathematics Learning, 6(3), 51–69. https://doi.org/10.1080/24727466.2014.11790335

Gunawan & Palupi. (2016). Taksonomi Bloom - Revisi Ranah Kognitif: Kerangka Landasan untuk Pembelajaran, Pengajaran, dan Penilaian. Jurnal Pendidikan Dasar Dan Pembelajaran, 2(2).

Ilma, R., Putri, I., & Aisyah, N. (2020). LEARNING INTEGERS WITH REALISTIC MATHEMATICS. 11(3), 363–384.

Isleyen, T., & Isik, A. (2003). Conceptual and Procedural Learning in Mathematics. In Journal of the Korea Society of Mathematical Educatio Series (Vol. 7, Issue 2, pp. 91–99).

Khashan, D. K. H. (2014). Conceptual and Procedural Knowledge of Rational Numbers for Riyadh Elementary School Teachers. Journal of Education and Human Development, 3(4), 181–197. https://doi.org/10.15640/jehd.v3n4a17

Lambertus, Sudia, M., Misu, L., Pasassung, N., & Daya, L. (2019). Senior high school students' different cognitive styles and their thinking processes in solving mathematical problems with scaffolding. International Journal of Innovation, Creativity and Change, 10(6), 163–174.

Muhtadi, D., Sukirwan, Warsito, & Prahmana, R. C. I. (2017). Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns. Journal on Mathematics Education, 8(2), 185–198. https://doi.org/10.22342/jme.8.2.4055.185-198

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of Triangle : Examples of Mathematical. International Journal on Emerging Mathematics Education, 1(1), 53–70.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. Journal on Mathematics Education, 3(2), 115–132. https://doi.org/10.22342/jme.3.2.1931.115-132

Rech, J., Grandgenet, N., & Zuya, H. E. (n.d.). Prospective Teachers ' Conceptual and Procedural Knowledge in Mathematics : The Case of Algebra. https://doi.org/10.12691/education-5-3-12

Riswan, Muhammad, S., & Kadir. (2018). Profile of Mathematical Problem Solving Ability of Grade VII Students Reviewed From Students' Cognitive Style. Journal of Education and Research, 6(3), 159–164.

Rozencwajg, P., & Corroyer, D. (2005). Cognitive processes in the reflective-impulsive cognitive style. Journal of Genetic Psychology, 166(4), 451–463. https://doi.org/10.3200/GNTP.166.4.451-466.

Sa'adah, A. N., Nizarudin, & Rahmawati, N. D. (2019). Analisis Kemampuan Berpikir Kreatif Siswa dalam Pembelajaran Matematika Ditinjau dari Gaya Kognitif Reflektif Siswa. Jurnal Matematika dan Pendidikan Matematika. 1 (5), 217-223.

Sahidin, L., Budiarto, M. T., & Fuad, Y. (2019). Developing vignettes to assess mathematical knowledge for teaching based conceptual. International Journal of Instruction, 12(3), 551–564. https://doi.org/10.29333/iji.2019.12339a

Salifu, A. S. (2021). Pre-Service Teachers ' Conceptual and Procedural Knowledge of Rational Numbers in E.P. College of. 10(4), 126–137. https://doi.org/10.11648/j.edu.20211004.13

Schneider, M., & Stem, E. (2010). The Developmental Relations Between Conceptual and Procedural Knowledge : A Multimethod Approach. I, 178–192.

Serhan, D. (2015). Students' understanding of the definite integral concept. International Journal of Research in Education and Science, 1(1), 84–88. https://doi.org/10.21890/ijres.00515

Stienstra, W. M. (2014). Developing understanding: Pre-service elementary teachers' changing conceptions of mathematics. Dissertation Abstracts International Section A: Humanities and Social Sciences, 75(3-A(E)), No-Specified. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc11&NEWS=N&AN=2014-99170-423

Sugiyono. (2018). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta

Warli, W. (2013). Kreativitas Siswa SMP Yang Bergaya Kognitif Reflektif Atau Impulsif Dalam Memecahkan Masalah Geometri. Jurnal Pendidikan Dan Pembelajaran (JPP), 20(2), 190–201.

Widodo, A. (2006). Revisi Taksonomi Bloom dan Pengembangan Butir Soal. Buletin Puspendik, 3, 18–26.

Zakaria, E., Haron, Z., & Mokhtar, M. T. (2007). Pengajaran dan Pembelajaran Matematik Berkesan. Trend Dalam Pengajaran & Pembelajaran Matematik, January 2007, 1–14.