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Development of Habits of Mind Mathematic Questionnaire for Junior High School Students

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ABSTRACT

Habits of thinking refer to the characteristics of students, especially in solving problems that will generate new thoughts. There are various characteristics of students in learning mathematics, one of which will be researched and developed based on the results of previous research, namely, making a mathematical habit of mind questionnaire. The developed questionnaire consists of 4 mathematic habits of mind, namely: (i) persisting or never giving up, (ii) managing metacognition, (iii) asking and posing problems, and (iv) applying past knowledge to new situations. Making the questionnaire uses a 4D model in stages, including define (definition), design (design), develop (development), and disseminate (distribution). The results of distributing the questionnaire to 160 students, all four types were successfully filled, namely persisting/never giving up as many as 46% of students, managing metacognition as many as 8% of students, asking & posing problems as many as 22% of students, and the habit of thinking mathematically using past knowledge to new situations as much as 24% of students. Of the four types of thinking habits developed, most students fall into type I: persistence/never giving up.

Keywords: Habits of mind Mathematic, 4D development model

INTRODUCTION

Mathematics has been studied since kindergarten or even before we entered the formal educational environment. (1) Therefore, an educator must be able to change a model or pattern in mathematics material to create comfort and impact students so that it seems fun. (2) Argues that student learning activities involve educators and students in solving problems using different methods and approaches. (3) The view is that students are not only oriented towards answers or the result of these problems and argue that problem-solving is also the subject of learning in mathematics learning activities, which shows how basic abilities are in the learning process . (4) (5) States that the goal is to improve problem-solving skills; developing skills in understanding problems, making mathematical models, solving problems, and interpreting solutions is necessary. As we are facing now, namely the 2013 education curriculum, which has the characteristic that students must also be active in the learning process and demand their intellectual intelligence in various discoveries or problems, the role of educators is in the same opinion as (6) Rusefeendi (2006), who said that so far In the process of learning mathematics in class, (7) students generally learn mathematics only by being told by educators and not through actual or field activities.

Each learner has logical thinking that becomes a habit of his way of thinking to improvise a mathematical model, solving with a different approach. The habit of thinking, which is commonly called the Habits Of Mind (8), according to Costa & Callick, 2000 is a characteristic of what

intelligent people do when they are faced with a problem related to learning a solution is not readily known by students. Then according to (9), the habit of thinking implies that behaviour requires a disciplined mind that is trained to become a habit and continue to try or process wisely and intelligently. (10)The habit of thinking can be developed through education and learning. Based on these various opinions, it can be concluded that the habit of thinking is a framework or a model of behaviour that can be used as a guide for each individual to think, act, and process in the context of learning at school. (11) Habits of Mind have a role in learning mathematics, namely:

a. Exploring mathematical ideas, which includes identifying data, facts, information, or appropriate problem-solving strategies.
b. Reflecting the appropriateness or correctness of the answer.
c. Formulating questions is a learning activity that will stimulate students' thinking skills.
d. Generalization means that learning mathematics must make knowledge or concepts and problem-solving strategies have a general nature.
e. Constructing examples play an essential role in developing students' thinking skills.

According to (12), the second edition of 2010, thinking mathematically is about mathematical processes, especially mathematics in certain branches. The initial goal of thinking mathematics is to show how to initiate a question, attack or deal with that question effectively and then how we learn from previous experiences or efforts to solve it. This mathematical thinking brings us closer to realizing the full potential of human thinking in a systematic, efficient, of course, mathematical way. *Mathematical thinking* is a dynamic process that extends the scope and depth of understanding of mathematics. By thinking mathematically, someone will build confidence without anxiety to solve problems, with the emergence of questions about mathematical problems.

This development research tries to group students into their thinking habits and the influence of their thinking habits. Efforts are being made to react to this as educators must know how the habits of thought of each student. (13) This can be achieved if educators are able to develop learning methods and models, one of which is by classifying students' thinking habits, for example, developing a questionnaire on students' thinking habits and distributing them to each individual student. Function as a tool, a method that aims to adapt educators to students in learning activities, especially in solving mathematical problems. By developing this Habits Of Mind Mathematic questionnaire, it can be an excellent alternative tool for educators in learning that can make.

MATERIALS & METHODS

Development research subjects were 160 students at SMP Negeri 3 Wates. This development uses the 4D (four - D) model, namely define, design, develop, and disseminate (14) (3) (S. Thiagarajan; Dorothy S. Semmel; Melvyn I. Semmel, 1974). (15) At the define stage, it defines how the habits of thinking mathematically are from several experts and comes from the opinions of researchers based on previous research, which is then composed of several indicators of all kinds of thinking habits. Then it is specified again into the habit of thinking mathematically or mathematically (habits of mind mathematics). (16) At the design stage, the aim is to design a questionnaire instrument. There are several essential points in the design of the questionnaire, including the classification of 4 types of habits of mind mathematics, arrangement of instruments, selection of media, an initial design containing questionnaire grids and habits of mind mathematic questionnaire instrument. (17) Furthermore, at the development stage, there are two types of validation used, namely expert validation, which involves

two mathematics education lecturers with doctoral qualifications and one mathematics teacher at SMPN 3 Wates with undergraduate qualifications and (18) empirical validation, according to questionnaire data that has been filled in by trial students using SPSS for windows. The final stage is the dissemination or deployment stage. This stage is the trial phase of the questionnaire on 160 students at SMP Negeri 3 Wates.

(19) The type of data obtained was in the form of descriptive quantitative analysis used to analyze data in the form of notes, suggestions or comments based on the validator's assessment found on the validation sheet and analysis of the types or categories of students' thinking habits in problem-solving and learning mathematics. (20) Quantitative analysis was used to analyze data in the form of scores from the results of student entries in the math habits of mind questionnaire to determine the reliability and validity of the items in the habits of mind mathematic instrument developed by the researcher.

RESULT AND DISCUSSION

Expert Validation

Based on the validation results from the three validators, they successively received suggestions for revision in each of the questionnaire items.

Table 1 Revised Expert Validation Results

Before Validation	After Validation
Habits of Thinking: Survive or never give up. Indicators: b. Considering many alternatives when solving a problem. What is the purpose of the alternative in the form of a way or solution? Statement : 3. I read math problems repeatedly when I had trouble understanding them problem. 4. I solve math problems in my way when I don't know the exact formula. More specification of looking for alternatives that show the exact formula.	Habits of Thinking: Survive or never give up. Indicators: b. Considering many alternative solutions when solving a problem What is meant by alternative in this indicator is a solution. Statement : 3. I look at various sources to solve difficult math problems. 4. I asked the teacher directly to solve problems that I couldn't understand.
Habits of Thinking: Survive or never give up Indicators: b. Considering many alternative solutions when solving a problem Statement : 3. I look at various sources to solve difficult math problems 4. I ask the teacher directly to solve problems that I cannot understand. Realize students' efforts in solving problems.	Habits of Thinking: Survive or never give up Indicators: b. Considering many alternative solutions when solving a problem Statement : 3. I look for solutions to solve difficult problems in the available material books. 4. I look for solutions to difficult problems through print and digital media sources.

Table 2 Acquired Expert Validation Score

V	ASPECT VALIDATION					SCORE	SCORE MAX	%	% AVERAGE
	1	2	3	4	5				
1	3	4	4	5	4	20	25	80	83
2	4	4	5	5	4	22	25	88	
3	4	4	4	4	3	19	25	76	
4	5	5	4	4	4	22	25	88	

The conclusion from this expert validation is declared fit for use without revision.

Information :

Validated Aspect 1: Survive/Never Give Up
Validated Aspect 2: Regulating Metacognition
Validated Aspect 3: Asking & Asking Problems
Validated Aspect 4: Applying Past Knowledge To New Situations

Table 3 Questionnaire Grid of Habits Of Mind Mathematic-Indicator of Types of Thinking Habits

Habits of Thinking	Indicator
Survive/Never Give Up	Persevere in learning b. Considering many alternative solutions when solving a problem c. Accustomed to democratizing systematic methods for analyzing problems d. Get used to distinguishing ideas that work and don't
Regulating Metacognition	a. Be aware of your thoughts and actions b. Accustomed to work or not according to plan c. Accustomed to drawing the steps used to solve problems d. Accustomed to planning strategies to generate the required information
Asking & Asking Problems	a. Accustomed to asking questions to collect data, test hypotheses, and make conclusions b. Accustomed to asking questions that stimulate the thinking of others c. Accustomed to asking effective questions (not just asking questions)
Applying Past Knowledge To New Situations	a. Accustomed to using existing knowledge to solve new problems b. Accustomed to relate what is being done now by analogy to past experience c. Accustomed to abstract the meaning of one experience and apply it in new situations

Table 4 Questionnaire Grid of Habits Of Mind Mathematic-Indicator of Types of Thinking Habits

Indicator	Items
Persevere in learning	1, 2
Considering many alternative solutions when solving a problem	3, 4
Accustomed to democratizing systematic methods for analyzing problems	5, 6
Get used to distinguishing ideas that work and don't	7, 8
Be aware of his thoughts and actions	9
Accustomed to work or not according to plan	10, 11, 12
Accustomed to describe the steps used to solve the problem	13, 14
Accustomed to planning strategies to generate the required information	15, 16
Accustomed to asking questions to collect data, test hypotheses, and make conclusions	17, 18, 19
Accustomed to asking questions that stimulate the thinking of others	20, 21
Accustomed to asking effective questions (not just asking questions)	22, 23, 24
Accustomed to using existing knowledge to solve new problems	25, 26
Accustomed to linking what is being done now with previous experiences	27, 28, 29
Accustomed to abstracting meaning from one experience and applying it in everyday life	30, 31, 32

Table 5 Statement Habits Of Mind Mathematic-Indicator of Types of Thinking Habits

Statement
1. I pay close attention to the math teacher's explanation.
2. I try to complete math problems even though they are difficult.
3. I look for solutions to solve difficult problems in the available material books.
4. I look for solutions to difficult problems through print and digital media sources.
5. I read the instructions carefully before working on a math problem.
6. I read the questions carefully so that I understand the meaning of the questions.
7. I try to solve math problems using a method that I understand.
8. I try to solve a math problem using another method.
9. I try to learn math material that the teacher hasn't taught me yet.
10. I find that one attitude that can help in learning math is understanding how to solve it.
11. I turn in math assignments on time.
12. I have a target score in mathematics so that I am motivated to study.
13. I have a regular math schedule.
14. I make small notes to remember learning math.
15. I have several ways. If I encounter a problem, I will choose a way to solve it quickly and efficiently.
16. I write down the problem-solving method that I use in answering math questions and have a certain strategy in learning mathematics.
17. I predict the concepts that will be used before doing math assignments.
18. I ask the teacher when I have doubts about my understanding in discussing concepts in mathematics material.
19. I asked the teacher if my opinion was correct or not in solving math problems.
20. I try to complete math problems even though they are difficult.
21. I volunteered to answer questions given by the teacher in learning mathematics.
22. I discuss with friends about math material that I don't understand well.
23. I read the instructions carefully before doing a math problem.
24. I ask the teacher about the mathematical solution if it is related to the relevant concept.
25. I ask questions with obvious reasons.
26. I ask questions in math class to understand better.
27. I asked if some other way the solution could be found.
28. I use the knowledge I already have to help me understand new material in mathematics.
29. I try to remember things I have learned when doing math problems.
30. I know that mathematics is related to each other.
31. Recalling the concept of previous mathematical material to study the next material.
32. Doing math assignments well will help me apply them in the real world.

Empiric Validation

The designed instrument was then submitted to the validator (expert review) and tested on 160 students for further quantitative and qualitative analysis.

Table 6 Test Result r_x* total *With Sign Value. 0.05 (Karl Pearson;1916)

Item	r_x total	Sign.	Information	Item	r_x total	Sign.	Information
1	0, 584	0, 001	Valid	17	0, 554	0, 001	Valid
2	0, 314	0, 001	Valid	18	0, 518	0, 001	Valid
3	0, 451	0, 001	Valid	19	0, 578	0, 001	Valid
4	0, 515	0, 001	Valid	20	0, 442	0, 001	Valid
5	0, 604	0, 001	Valid	21	0, 504	0, 001	Valid
6	0, 390	0, 001	Valid	22	0, 504	0, 001	Valid
7	0, 500	0, 001	Valid	23	0, 659	0, 001	Valid
8	0, 386	0, 001	Valid	24	0, 437	0, 001	Valid
9	0, 501	0, 001	Valid	25	0, 685	0, 001	Valid
10	0, 346	0, 001	Valid	26	0, 622	0, 001	Valid
11	0, 470	0, 001	Valid	27	0, 618	0, 001	Valid
12	0, 547	0, 001	Valid	28	0, 505	0, 001	Valid
13	0, 474	0, 001	Valid	29	0, 320	0, 001	Valid
14	0, 559	0, 001	Valid	30	0, 400	0, 001	Valid
15	0, 625	0, 001	Valid	31	0, 532	0, 001	Valid
16	0, 600	0, 001	Valid	32	0, 368	0, 001	Valid

Table 7 Reliabilitas Cronbach's Alpha

Reliability Statistics	
Cronbach's Alpha	N of Items
,904	32

In table 6 shows that the 32 statements in the questionnaire are valid. Because each statement's significance value is 0.001, which means less than 0.05 or <0.05 which is valid. The data can be said to be reliable because the average Cronbach's Alpha value of 32 statements is 0.904. The Cronbach's Alpha value has a value ranging from 0.9 to 1.0 which has a very high interpretation (21) (Creswell & Creswell, 2014, p. 334). Figure 1 below shows the results of the percentage of each student in the tendency to think mathematically.

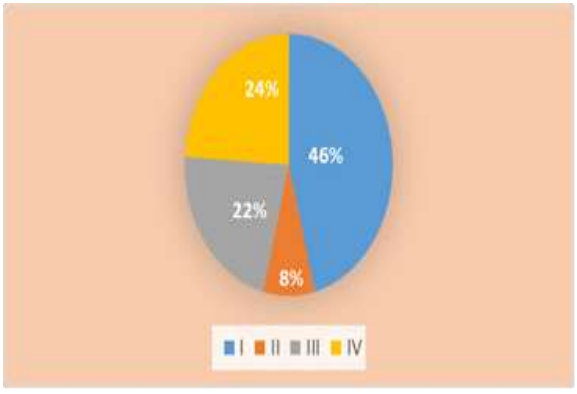

Figure 1 Percentage of Student Classification Results in their Habits of Thinking

CONCLUSION

A questionnaire of habits of mind mathematics has been produced in development research:

1. A valid and reliable mathematical habits of mind questionnaire.
2. Classification of 4 types of thinking habits of 160 junior high school students, namely:

- Habits of mind mathematic type I persist/never give up, there are 46%, totalling 74 students.
- Habits of mind mathematic type II mathematic habits of mind regulate metacognition. there are 8%, totalling 12 students.
- Habits of mind mathematic type III asking & posing problems are 22% totalling 35 students.
- Habits of mind mathematic type IV uses past knowledge tp new situations, there are 24%, totaling 39 students.

Declaration by Authors

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REFERENCES

1. Hutajulu M, Minarti ED. Meningkatkan Kemampuan Advanced Mathematical Thinking Dan Habits of Mind Mahasiswa

Melalui Pendekatan Keterampilan Metakognitif. JES-MAT (Jurnal Edukasi dan Sains Mat. 2017;3(2):177.
2. Nurmala N, Rohaeti EE, Sariningsih R. Pengaruh Habits of Mind (Kebiasaan Berpikir) Terhadap Pemecahan Masalah Matematik Siswa Smp. J Educ [Internet]. 2018;1(2):163–8. Available from: https://www.jonedu.org/index.php/joe/article/view/41
3. Dwirahayu G, Kustiawati D, Bidari I. Pengaruh Habits of Mind Terhadap Kemampuan Generalisasi Matematis. J Penelit dan Pembelajaran Mat. 2018;11(2).
4. Musliha A. Analisis proses berpikir dalam pemecahan masalah dengan kategori menurut polattsek ditinjau dari. 2017;
5. Arif Nasrulloh M, Veni Rahayu D. Proses Berpikir Divergen Matematis Peserta Didik Dalam Menyelesaikan Soal Open Ended Ditinjau Dari Habits of Mind. J Penelit Pembelajaran Mat. 2022;15.
6. Sugianto R, Darmayanti R. Stage of Cognitive Mathematics Students Development Based on Piaget's Theory Reviewing from Personality Type. Plusminus J Pendidik Mat. 2022;2(1):17–26.
7. Lanani K. Belajar Berkomunikasi Dan Komunikasi Untuk Belajar Dalam Pembelajaran Matematika. Infin J. 2013;2(1):13.
8. Gloria RY. Costa-Kallick'S Habits of Mind in Practical Activities of Students As Teachers Candidate. Edusains. 2018;10(1).
9. Qadarsih ND. Pengaruh Kebiasaan Pikiran (Habits of Mind) Terhadap. Jurnal. 2017;2(2):181–5.
10. Rahayu P, Iriawan SB, Fitriani AD. Perbedaan Kebiasaan Berpikir Matematis Dan Hasil Belajar Antara Model Amora Dengan Konvensional. J Pendidik Guru Sekol Dasar [Internet]. 2020;(Iii):106–19. Available from: https://ejournal.upi.edu/index.php/jpgsd/article/view/30053/13360
11. Sumartini TS. Pengaruh Habit of Mind terhadap Kemampuan Berpikir Kreatif Matematis melalui Metode Pembelajaran Improve. Mosharafa J Pendidik Mat. 2022;11(1):167–78.
12. Mason J, Burton L, Stacey K. Thinking Mathematically Second Edition. 2010. 242 p.
13. Miliyawati B. Urgensi Strategi Disposition Habits of Mind Matematis. Infin J. 2014;3(2):174.
14. Savira F, Suharsono Y. Bab Iii Metode Penelitian Dan Pengembangan. J Chem Inf Model. 2013;01(01):1689–99.
15. Muqdamien B, Umayah U, Juhri J, Raraswaty DP. Tahap Definisi Dalam Four-D Model Pada Penelitian Research & Development (R&D) Alat Peraga Edukasi Ular Tangga Untuk Meningkatkan Pengetahuan Sains Dan Matematika Anak Usia 5-6 Tahun. Intersections. 2021;6(1):23–33.
16. Rumiati SW. Instrumen Penilaian Hasil Belajar Matematika SMP : Belajar dari PISA dan TIMSS. Yogyakarta Pus Pengemb dan Pemberdaya Pendidik dan Tenaga Kependidikan Mat. 2011;55.
17. Zuliani D, Florentinus TS, Ridlo S. Pengembangan Instrumen Penilaian Karakter pada Siswa Kelas IV Sekolah Dasar. J Res Educ Res Eval. 2017;6(1):46–54.
18. TEMA 11. No Analisis Struktur Kovarian Indeks Terkait Kesehatan untuk Lansia di Rumah, Berfokus pada Perasaan Subjektif tentang Kesehatan Title. J Mater Process Technol [Internet]. 2018;1(1):1–8. Available from: http://dx.doi.org/10.1016/j.cirp.2016.06.001%0Ahttp://dx.doi.org/10.1016/j.powtec.2016.12.055%0Ahttps://doi.org/10.1016/j.ijfatigue.2019.02.006%0Ahttps://doi.org/10.1016/j.matlet.2019.04.024%0Ahttps://doi.org/10.1016/j.matlet.2019.127252%0Ahttp://dx.doi.o
19. Nizhomi B, Nisa AF, Pusporini W. Implementasi Model Pembelajaran Flipped Classroom Guna Meningkatkan Interaksi Belajar Mahasiswa Pada Mata Kuliah Pembelajaran Tematik SD. Caruban J Ilm Ilmu Pendidik Dasar. 2022;5(2):140.
20. Mulvia R, Ulfa S, Ady WN. Rasch Model: Identifikasi Kemampuan Habits Of Mind Peserta Didik SMA. J Pendidik dan Ilmu Fis. 2021;1(1):15.
21. Dwirahayu G, Kustiawati D, Bidari I. Corresponding Habits of Mind and Mathematical Ability. J Phys Conf Ser. 2017;895(1).

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