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Developing specialized thinking for elementary students

DUONG MINH TOI
Titan Education, 94 Mac Dinh Chi, DaKao Ward, District 1
Ho Chi Minh Ctiy, Viet Nam

Abstract

Thinking is a highly cognitive process, only humans have. Unlike feeling and perception, thinking is general, which means reflecting on the general and implementing it through concepts. Thinking in general and specialized thinking, in particular, help us understand the laws of the development of things. The thinking process begins with the discovery of the problem that needs to be answered. Thinking is always aimed at solving a specific problem, a specific task. When we tell students to think, we always have to put forth a clear problem and what to think about in order to solve the problem posed. Our research deals with specialized thinking in teaching math for primary school students. We tested the case and obtained feasible and effective results. Research has shown that specialized thinking helps primary school students approach age-appropriate math problems, persevere, and love math more. These students were more active, proactive, and excited about the way of teaching thinking development than with conventional teaching.

Keywords: Thinking, specialized, elementary school students, characteristics, creative thinking.

INTRODUCTION

Characteristics of Thinking

Thinking is a creative activity, the result obtained after thinking is always something new in the perception of the thinking person. For example, in learning, that new thing is a rule, a theorem, a concept. If a question or a problem that children can answer very easily because just using existing knowledge, then there is no thinking but only memory. Thinking is based on the analytic and synthetic activity of the cerebral cortex. Thinking and language are closely related, but thinking and language are not the same (Level 1 Psychology Group, Institute of Educational Sciences, 1977).

Thinking reflects things, thanks to the generality that we know things more fully, not only know the phenomena of things but also the nature of things (ie the governing laws), not only present, but also the future of things. In addition, thinking also has an important feature of indirectly reflecting things. It only takes a few signs of things that man can know the whole thing, which human senses cannot reflect. For example, based on a few fossils, archaeologists know life on Earth tens of thousands of years ago (Nguyen, 1998).

Thus, thanks to thinking, people perceive things in a deeper and broader way. In learning, thinking is very necessary and the basic process to master knowledge.

LITERATURE REVIEW

Some Types of Thinking

According to researchers, thinking has many different classifications depending on the purpose of use. Within the scope of our research, we offer the following types of thinking:

Convergent thinking

Convergent thinking is a type of thinking that gives a specific, precise answer to a problem. This type of thinking forces us to go in one direction, without requiring any significant creativity (Cdn.talentsprint.com, 2021).

Convergent thinking is oriented towards giving the best or clear answer to the question. It emphasizes accuracy and logic as well as focuses on applying familiar skills in problem-solving. Convergent thinking is therefore most effective in situations where answers exist. Convergent thinking leaves no room for ambiguity, so the answers are either right or wrong. Convergent thinking is closely related to knowledge. On the one hand, it applies existing knowledge, on the other hand, it expands knowledge (Fazelipour et al. 2008).
Convergent thinking is the ability to use logical thinking, evaluation, critical thinking, and narrowing down the ideas that are most relevant to the problem posed. Convergent thinking emphasizes individuality, precision, and science. Convergent thinking is at the core of engineering processes (Fry, 2007).

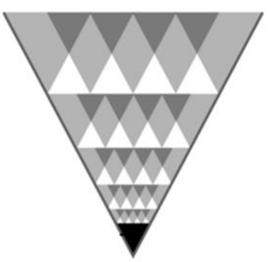


Figure 1. Convergent Thinking Model (Fry, 2007)

Divergent thinking

Divergent thinking is a type of thinking that develops knowledge based on our experience and knowledge, offering different solutions to develop the problem we are interested in. The answer may not be specific, it may be an open-ended answer (Cdn.talentsprint.com, 2021).

Unlike convergent thinking, divergent thinking specifically involves expanding knowledge by answering multiple questions or exploiting and developing available information. Divergent thinking requires the combination, association, and transformation of information into similar or extended knowledge. Divergent thinking can vary from person to person (Fazelipour et al. 2008).

Divergent thinking is thinking that creates many ideas and problems from the original idea or problem. Divergent thinking looks for solutions by branching out, connecting existing perceptions with new knowledge. Divergent thinking accepts ambiguity, risks, encourages curiosity, courage, and flexibility of the researcher. Divergent thinking is at the core of industrial design processes (Fry, 2007).

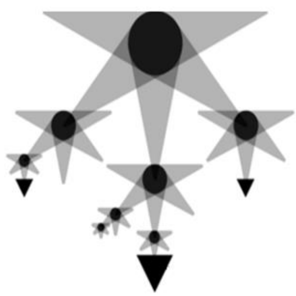


Figure 2. Divergent Thinking Model (Fry, 2007)

Reflective thinking

Reflective thinking is a type of thinking that is based on past memories, experiences, and results that we have achieved or failed to achieve in a certain particular situation of ours. Based on these flashbacks and past experiences, we will shape our current problem-solving approach (Cdn.talentsprint.com, 2021).

Reflective thinking includes five important and necessary skills: observation, communication, teamwork, judgment, and decision-making (Mirzaei et al. 2014). This is the mindset required to identify, analyze and solve complex problems (Spalding & Wilson, 2002).

Reflective thinking is the habitual thought-generating process that allows one to connect theoretical knowledge with practice (Choo et al. 2019). Teachers encourage and lead students to participate continuously before, during, and after thinking activities. The model of thinking activities consists of the following three steps:

Figure 3. Model of Reflective Thinking Stages in Class (Choo et al. 2019)

Logical thinking

Logical thinking is thinking about the necessary and regular cause-and-effect relationship. Therefore, factors and objects (collectively referred to as factors) in logical thinking must have a relationship with each other, of which the causal factor is the premise, the other factor is the result or conclusion (Chu, 2016).

Logical thinking is thinking correctly, following the rules, not making mistakes in reasoning, knowing how to detect contradictions, qualities of thinking that are of great value in any field of scientific activity and practice. Human logical thinking is not innate, but it must be formed, trained, consolidated, and developed regularly (Vuong, 2007).

Logical thinking is correct thinking, complying with logical rules and forms on the basis of the premise of true thinking, helping people not to make mistakes in reasoning, and knowing how to detect contradictions. The basic laws of logical thinking require in the thinking process to strictly maintain the identity of the premises, from which the conclusions drawn are correct. If in the course of reasoning we swap and change the content of the premises, it will be impossible to come to the correct conclusion. These laws are obligatory in a structural form of thinking precisely in terms of reflecting the relative stability to which all people and all sciences must obey (Vu et al. 2007).

Logical thinking is the process of perceiving an object, identifying factors related to the formation and connection of ideas, in order to find solutions and act in accordance with the context of the object (Nguyen, 2019).

Logical thinking is a form of thinking characterized by the ability to draw conclusions from given premises, the ability to classify individual cases to fully investigate an event, the ability to predict specific outcomes of theory and generalize the conclusions obtained (Phan et al. 2015).

Logical thinking is thinking based on practical proof and refutation and existing arguments by applying concepts, judgments, and inferences to the process of performing operations such as analysis, synthesis, comparison, analogy, classification, systematization, abstraction, and generalization to infer more accurate results, more realistic approach, more faithfully reflect the nature of objects (Ha, 2007).

Lateral thinking

According to the Oxford Advanced Learner's Dictionary, "lateral thinking" means "A way of solving a problem by using your imagination to find new ways of looking at it" (Hornby, 2005).

Lateral thinking is a form of thinking that goes beyond the limits of normal thinking. This mindset encourages creativity and finding new alternatives (Klopčič, 2004). It is a way of solving problems through an indirect and creative approach, which normal logical thinking would not answer. New ideas emerge only when we challenge the very assumption of the problem (Gabennesch, 2002).

Lateral thinking is a type of thinking that helps us have a deeper perspective, even a way of seeing beyond what many people think. Lateral thinking is a type of creative thinking. This kind of thinking helps us to develop relationships between things and phenomena with other things and phenomena and the internal relationship of things and phenomena (Cdn.talentsprint.com, 2021).

Lateral thinking is thinking that is not based on relationships between the elements of an object or between objects. Elements that do not belong to the object but are assigned to the object, objects that have no relation to each other are bound to certain relations and vice versa, elements belonging to the object are separated from the object, some necessary relationships between objects are removed. Lateral thinking is derived from the logic of thinking, which in some limits or specific cases also fully manifests the properties of logical thinking, so they make it difficult to distinguish them from logical thinking (Chu, 2016).

Critical thinking

Critical thinking is a general term for cognitive skills and intellectual orientation to identify and analyze problems effectively. This thinking is based on evaluating arguments, ignoring preconceptions and prejudices, and formulating and presenting arguments in favor of counterarguments. It requires making rational and intelligent decisions about what to do (Chaldini et al. 2001).

Critical thinking is the process of using reason to distinguish between right and wrong; It is closely related to logic and its fallacies. Critical thinking helps us to expand our knowledge (Gabennesch, 2002).

Critical thinking is the process of conceptualizing, applying, analyzing, synthesizing, and evaluating information gathered or generated from observation, experience, reflection, reasoning, or communication in an active, skillful, and intellectually trained manner, as a guide to beliefs and actions (Chu, 2016).

Critical thinking is a type of thinking characterized by the ability to question and test inferences, whether the assumptions made are true or false, and whether the assumptions and conclusions of the problem are ambiguous or not. We must use our knowledge to analyze, synthesize and evaluate the problem to identify the correctness or uncertainty of the problem and its solution (Islamia, 2001).

Critical thinking is thinking that is critical and deliberate in order to make rational decisions when understanding or implementing a problem. Critical thinking is closely related to analysis because, in order to be critical, one must consider, dissect, and analyze the knowledge, facts, relationships, and problems under study (Le, 2008).

Functional thinking

Functional thinking is intellectual activities related to the correspondence between the elements of one, two or more sets, reflecting the interdependence relationship between the elements of those sets, in the movement of the elements (Dinh et al. 2001).

Functional thinking is a mathematical thinking process with the following four activities simultaneously. First, identify whether the corresponding (encountered) rules are a number or not. Second, discover the univariate correspondence of two variable quantities in the context of many variable quantities. From there, the corresponding rule is established between two variable quantities (a function). Third, study the newly established functions. Finally, take advantage of the above-mentioned studies on functions to solve the posed problem (according to (Le, 2007)).

Functional thinking is a mode of thinking characterized by the recognition of the process of developing general and specific relationships between mathematical objects or between their properties (and by the skill of using cognition in those relationships). Functional thinking is clearly expressed in connection with one of the main ideas of high school math textbooks, which is functional thought (Le, 2007).

Functional thinking is a mode of thinking represented by the following characteristic activities. The first is the activity of detecting and establishing correspondence. The second is the activity of studying correspondence. The third is the act of taking advantage of correspondence. Functional thinking is understood as the perception of the process of change, relationship, and interdependence of mathematical concepts and relationships (Chu, 2016).

Dialectical thinking

Dialectical thinking is a form of thinking that considers things in unity and contradiction, in movement and development and in relationship and dependence with other things. The dialectical nature of thinking is characterized by the following realizations. First, change is characterized by movement and development. Second, duality is characterized by contradiction and unity. Third, comprehensiveness is characterized by the interrelationship and interdependence of concepts and relationships (Nguyen, 2010).

Dialectical thinking is characterized by the insight into the variability, the two-way, the contradiction, by the interrelationship and interdependence of concepts and relationships. In addition, dialectical thinking also manifests in the ability to have unframed, multi-faceted views when studying objects and phenomena that occur or when solving problems (Nguyen, 2010).

The first dialectical thinking is natural scientific thinking; Its relationship with mathematical thinking cannot be arranged in a certain dominant order (Nguyen, 2010).

To learn math creatively, logical thinking alone is not enough. Dialectical thinking is very important because it helps us detect problems and orient to find ways to solve problems; it helps strengthen our confidence when our search temporarily fails; then we firmly believe that one day we will succeed and aim for success. Try to see each mathematical concept in as many different ways as possible (Nguyen, 1997).

CREATIVE THINKING OF PRIMARY SCHOOL STUDENTS

Psychological characteristics of elementary school students

According to Ly Minh Tien and his colleagues, the nervous system of primary school students is in a period of strong development. By the age of 9, 10, a child's nervous system is basically complete and its quality will be maintained throughout life. Students at the beginning of elementary school lack the ability to synthesize, so their attention doesn't last long, they are the most scattered, and they are easily attracted to the intuitive and sexy. At the same time, the attention is not high, so the students at the beginning of primary school do not know how to organize their attention. Attention is often directed outwards to activities, not inwards, to intellectual activities. However, students at the end of primary school have a higher ability to concentrate and identify their learning motivation more clearly (Huynh et al. 2012).

Although developed, memory is still affected by inspiration and patterns. Younger students do not yet know how to organize meaningful memory and they tend to develop mechanical and visual memory rather than logical memory. However, according to practical experiments, the memory of students at the end of primary school has gradually become intentional, sustainable, and logical; students are aware of highly abstract concepts, formulas, and rules (Huynh et al. 2012).

In cognitive psychology, Piaget proposes the theory of activation to describe different logical structures that are inherited in the process of human intellectual development from birth to adulthood. He believes that children's thinking forms and develops continuously in each specific stage. The ability to analyze, synthesize, generalize and abstract is still rudimentary in the first grades of primary school, mainly only performing analytical, visual, and action activities when directly perceiving objects. However, the ability to analyze, synthesize, generalize, and abstract in the learning process has developed dramatically; elementary school seniors can analyze an object without actually taking action on it (Dorling Kindersley, 2019).

Thus, over time, the thinking activities of primary school students have many fundamental changes. The thinking of elementary school students has been relatively developed, mainly students at the end of elementary school. The change from concrete and intuitive thinking to abstract and generalized thinking prevails and is a new and prominent feature of thinking activities of students at the end of primary school.

Primary school students' thinking

In Piaget's studies, he asserted that all children go through the ordered stages, without jumping or regressing to the previous stage.

The four stages identified by Piaget represent the child's levels of intellectual development as follows:

- The first stage, the sensory phase, is about the first two years of a child's life. During this period, infants learn to perceive the world primarily through their senses and through physical or motor activities.
- The second stage, the pre-manipulation stage, is from about 2 to 5 years old when children begin to care about how things look. Children begin to demonstrate skills such as arranging objects in a logical order or comparing objects by common properties.
- The third stage, the concrete manipulation stage, from about 5 to 11 years old, is when children begin to be able to perform logical operations, but only when there are (concrete) objects in reality. Specific operations are transitions between actions and general logic constructs. The period of 5-7 years old is the period of organization and preparation, and the period from 8 to 11 years old is the time to complete these operations.
- In the fourth stage, the stage of formal manipulation, from about 12 to 16 years of age, children begin to use thoughts (instead of simple objects) and have the ability to think purely on words (Dorling Kindersley, 2019).

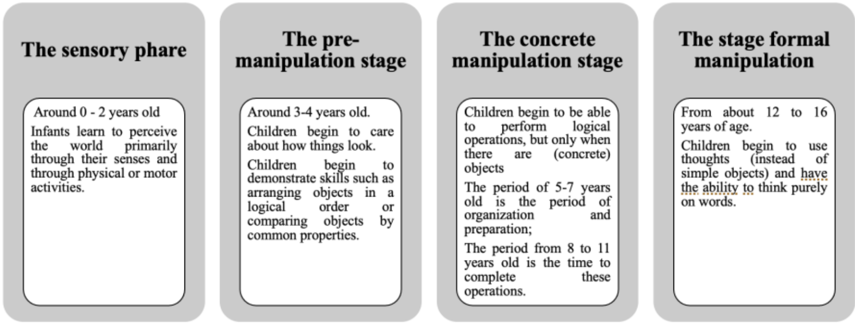


Figure 4. Four Stages of Cognitive Development
(Source (Dorling Kindersley, 2019))

In general, it can be seen that cognitive development in children goes through four major periods, each with its own cognitive construction, one after the other by building new, transcending the old. The successive development of stages speaks of a hierarchical succession of successive cognitive structures.

In order for students to start thinking, we need to pose a new problem to them. In the process of solving that new problem, students can apply previous knowledge to new situations. Students' thinking develops in the process of understanding the foundations of science, in the process of understanding the main laws of nature and society. At the same time, grasping scientific concepts requires students to have a higher level of abstraction, to have higher forms of generalization with age (Daparogiet, 1974).

METHODOLOGY

Developing Specialized Thinking Operations through Elementary Math Problems

Students can approach the original problem with specific and simple cases such as changing specific numbers, special drawings, trying and checking, etc., thereby predicting results, understanding, and solving this specific and simple problem. This method helps students to orient how to solve complex new problems.

In addition, the method of developing specialized thinking manipulation also helps students find new problems. However, the new math results are just new compared to themselves. Students are not passive in their learning but actively develop their own knowledge.

With the specialization method, a problem for which we have not found any other solution, we can change the data of that problem. For example, with the problem: a staircase has 10 steps, each time An can step one or two steps. How many ways are there for An to finish the stairs? To make it easier, instead of listing cases with stairs with 10 steps, students can approach the problem more simply with stairs with 1 step (with 1 way), 2 steps (with 2 ways), 3 steps (there are 1 + 2 = 3 ways),…. In this way, we get the problem that is a special case, easier to handle than the original problem (according to (Polya, 2010)).

Teaching Process to Develop Specialized Thinking Operations through Elementary Math Problems

Step 1. Identify the specialization problem

Teachers help students discover the relationship between some known factors and related factors to understand the problem in question. Students ask questions to identify and discover problems that can be specialized. In this thesis, we use two types of specialization: solution specialization and problem specialization.

Step 2. Come up with a solution to the specialized problem

From the teacher's comments, suggested questions and the results obtained in special cases, students analyze and sequence relevant knowledge to come up with ways to solve the mentioned problems.

Step 3. Dig deep into the new problem

The teacher asks students if it is possible to develop and exploit this problem with other special cases. The teacher helps students to speak and complete the new specialization problem (if any).

Step 4. Repeat the above steps (if any)

From the problem stated in step 3, students and the teacher continue to return to step 1 of the process.

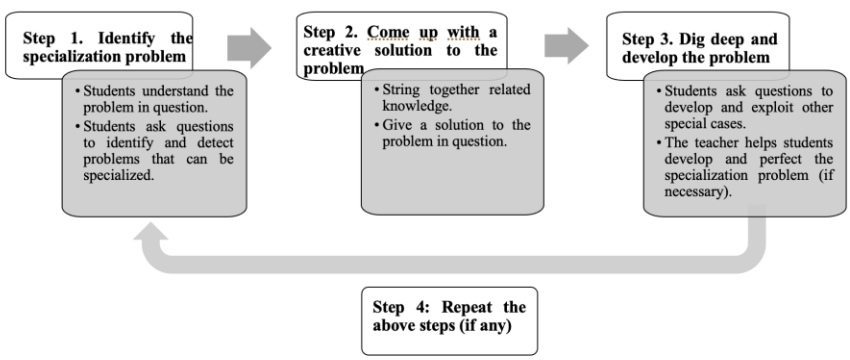


Figure 5. Teaching Process to Develop Specialized Thinking Operations

Illustrative Examples

Example 1 (Numbers and calculations)

An wrote on the board a 4-digit number. Binh added the digit 5 to the left of An's number. How does Binh's number change compared to An's number?

Table 1. Acts of students and teacher of Example 1

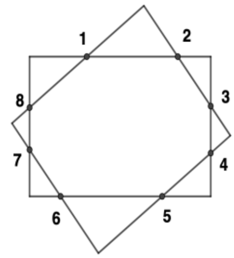
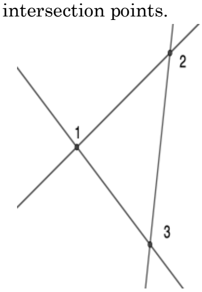
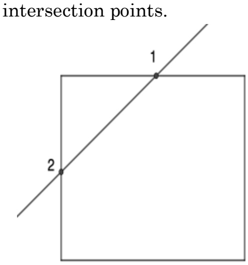
Teacher's activities	Student activities
Step 1. Identify the specialization problem	
Do you know what number An wrote? Try to write any four-digit number. Call and ask any student about the number and write it on the board. Ask students to add 5 to the left of the 4-digit number they just wrote. Ask students to comment on the number they just wrote compared to the original number.	Listen and answer: We don't know. Each student writes a random four-digit number. Read their number, for example 1234. 51234 This number is larger than the original number: 51234 – 1234 = 50 000 units
Step 2. Come up with a solution to the specialized problem	
Comment: Each student writes a different number but the same result is greater than 50000 units. When you write 5 to the left of a 4-digit number, how many digits will you get? In what row do you add the digit 5? Will the initial digits (thousands, hundreds, tens, units) change or not? Please comment and answer the original problem.	Listen and check their results. A five-digit number Tens of thousands No change When adding the digit 5 to the left of a four-digit number, the new number is 50,000 units larger than the original number.
Step 3. Dig deep and develop the specialized problem	
If the digit 5 is added to the left of the number 0, how does the new number compare to the original number?	Debate whether the result is greater than 5 or 50 units.
Step 4. Repeat the specialization process	
Ask students to return to steps 1, 2 to solve the problem for the special case in step 3. Comment and point out the initial wrong results of some students: Do not confuse adding the digit 5 to the left of 0 with replacing the digit 0 with the digit 5 (the wrong result is greater than 5 units).	Write the number 0, write the digit 5 to the left of the number 0. Answer: The new number is 50 units larger than the original number. Listen and absorb

Example 2. (Geometry and measurement)

Two rectangles and three lines are drawn together on the same piece of paper. At most how many intersections can be created when drawing?

Table 2. Acts of students and teacher of Example 2

Teacher's activities	Student activities
Step 1. Identify the specialization problem	
Ask students to draw 2 rectangles and 3 lines on the paper. Then count how many intersections there are in all. Comment: mixed results. How do we know which result is the most? Can you solve the problem by separating it from the individual case?	Draw and count the number of intersections. Listen and think Listen and think
Step 2. Come up with a solution to the specialized problem	
Draw and show how many intersection points	Draw a picture and answer that there are at

two rectangles have.	most 8 intersection points. 
Draw and show how many intersections three lines have at most.	Draw a picture and answer that there are at most 3 intersection points. 
Draw and show how many intersection points a line and a rectangle have at most.	Draw a picture and answer that there are at most 2 intersection points. 
Can you tell me how many intersections is the maximum number of intersection points for a line that intersects 2 rectangles? Can you tell me how many intersections is the maximum when 3 lines intersect 2 rectangles?	Think and answer: 2×2=4 intersections Think and answer: 4×3=12 intersections
What is the total number of intersections of 2 rectangles, 3 lines, 3 lines, and 2 rectangles?	Add the intersections and answer: 2 rectangles intersect at 8 intersection points 3 lines intersect at 3 intersections 3 lines intersect 2 rectangles at 12 intersections. The total number of intersections is 8+3+12=23 intersection
Step 3. Dig deep and develop the specialized problem	
2 squares and 3 lines are drawn together on the same piece of paper. At most how many intersections can be created when drawing?	We see that the role of squares and rectangles in this problem is the same, so the total number of intersections is still 23.
Step 4. Repeat the specialization process	
If students do not know how to comment to get the answer right away, they should go back to steps 1 and 2 to solve this specialized problem.	

Comment: We used specialized thinking manipulation to separate the problem into smaller and simpler problems; then synthesize the solutions and results to solve the original problem.

Example 3. (Some statistical and probability factors)
There are n people in a press conference. Each person shakes hands with all the others once. How many handshakes are there in all?

Table 3. Acts of students and teacher of Example 3

Teacher's activities	Student activities
Step 1. Identify the specialization problem	
Do you know exactly how many people there are at the press conference? If there are two people, how many handshakes are there? If there are three people, how many handshakes are there? If there are 5 people, ask students to think about how to shake hands?	No, we don't. There is one handshake. Think and answer that there are three handshakes. Think
Step 2. Come up with a solution to the specialized problem	
Call 5 people A, B, C, D, E. Who does Person A shake hands with? And how many handshakes? Each person shakes hands 4 times, so how many handshakes are there in all 5 people? How many times is the handshake between A and B counted? So how many handshakes do 5 people have? If there are n people at the press conference, how many people does one person shake hands with? So, with n people, how many handshakes are there in all?	A shakes hands with B, C, D, E. There are 4 handshakes. $4 \times 5 = 20$ handshakes. Calculate 2 times (calculate for A and calculate for B) $4 \times 5 \div 2 = 10$ handshakes With the remaining $(n - 1)$people $(n - 1) \times n \div 2$ handshakes.
Step 3. Dig deep and develop the specialized problem	
On a line with 5 points, how many line segments are there in all that are created from these 5 points?	We see that two points form a line, so this is a special problem of the problem of the number of handshakes with the case n=5.
Step 4. Repeat the specialization process	
If students do not know how to comment to get the answer right away, they should go back to steps 1 and 2 to solve this specialized problem.	

FINDINGS/RESULTS

We have called and discussed directly with parents to get information and some initial assessments as follows:

Table 4. Initial Assessments

Student information	Related information	Initial evaluation
Pham Tri Dung Grade 5 Last semester grade: 9 Academic ability: very	Family background: Dung has an older sister, attends an international school; his parents are business owners, and his father spends time studying with	He studies very well, works hard, does all his homework. He actively interacts with teachers, takes initiative in

good	his children on weekends. Hobbies: English, STEM,…. Advantages: Likes to study math, English. Limitations: Occasionally loses focus, nearsightedness. Objective: Tran Dai Nghia entrance exam and study abroad later.	learning, and has a very good sense of learning. He is friendly, very carefree, and capable of independent learning.
Ngo Minh Tiep Grade 5 Last semester grade: 8 Academic ability: good	Family background: He is the only child in the family. His parents do business but are very interested in monitoring their children's education. Hobbies: Sports, fishing. Advantages: Likes to study math, English. Limitations: Slow writing Objective: Tran Dai Nghia entrance exam.	He studies well, works hard, does all his homework. He actively interacts with teachers, has a good sense of learning. He is friendly, cheerful, and well-liked by his friends, capable of independent learning.
Pham Duc Tri Grade 5 Last semester grade: 6 Academic ability: fair	Family background: He has an older brother, his father is a business manager, his mother is a human resources officer; his parents teach children to be self-reliant, and promote mathematical thinking. Hobbies: Reading Advantages: Self-directed learning is quite good Limitations: Talkative, not careful. Objective: Take the entrance exam to Tran Dai Nghia school, and later plan to major in Mathematics.	He is academically fair, hardworking, tries to do his homework, sometimes interacts with teachers. Fun, talkative.
Nguyen Minh Tri Grade 5 Last semester grade: 4 Academic ability: Not yet passed	Family background: He has a brother, he knows how to talk later than other children; the family has a method of understanding and training children. Hobbies: Likes soccer. Advantages: Likes to exercise Limitations: Losing concentration, not identifying learning goals.	He has poor academic performance, does not do enough homework. He rarely interacts with teachers and is a passive person.
Luan Y Tran Grade 4 Last semester grade: 9.5 Academic ability: very good	Family background: He is an only child, his parents are auditors, the family is very interested in his child's education. Hobbies: reading books Advantages: Can speak many languages, diligent. Limitations: Too perfectionist, slow processing. Objective: Apply flexible thinking, study abroad.	He studies very well, works hard, does all his homework. He actively interacts with teachers, is active in learning, and has a very good sense of learning. Friendly and very carefree, capable of independent learning.
Than Minh Tam Grade 4 Last semester grade: 7 Academic ability: Good	Family background: there are 3 sisters in the family, her mother is a lecturer, her father is a businessman; her parents care about their children's education. Hobbies: Traveling, studying Math. Strengths: Diligence.	She studies quite well, works hard, does all her homework. She does not react quickly, handles math problems slowly and carefully. She is cheerful and gets along with her friends.

	Limitations: Do the homework too fast. Objective: Study to be better, enter Tran Dai Nghia school and study abroad.	
Duong Hong Minh Chau Grade 4 Last semester grade: 6 Academic ability: fair	Family background: there are 3 sisters in her family, her father is an engineer, her mother is an office worker. Hobbies: drawing, reading books. Pros: Fun, sociable. Cons: Not good at math Goal: Get better at math.	She has a fair academic record, does most of her homework. She interacts with teachers well, is in a hurry, and makes some basic mistakes. She is cheerful and loves to chat with her friends.
Luong Ngoc Tram Grade 4 Last semester grade: 4.5 Academic ability: Not yet passed	Family background: there are two brothers in her family, her father is a lecturer, her mother is an office worker. Hobbies: Basketball, piano. Advantages: Likes to exercise Limitations: Not doing well in science and math. Goal: Get better at math.	She has poor academic performance, has not spent much time studying at home. She sometimes interacts with teachers and is not careful while dealing with math problems. She is cheerful and sociable with her friends.

During the experiment, we observe and record the changes of students. We receive positive feedback and comments on student progress from tutors and parents. The results show that the students' spirit and attitude to study are better, more excited, and vibrant; Students complete their homework and prepare well in advance, so the progress of the class is also faster.
Below is the evaluation table recorded during the experiment.

Table 2. Experiment

Full name	After 3 lessons	After 6 lessons
Pham Tri Dung Grade 5 Schoolwork: Appendix figure 6.1 Score: 9.5/10	His concentration has improved. He actively interacts with the teacher. His presentation has improved.	His presentation is good and his reasoning is tight. He stays positive during class and completes his homework very well. The test fulfills all requirements. Students only make mistakes in calculations.
Ngo Minh Tiep Grade 5 Schoolwork: Appendix figure 6.2 Score: 10/10	He worked hard to present but still complained. He feels less pressure when studying.	He presents clean and well-reasoned arguments. He actively interacts, speaks, and gives opinions. He has improved a lot compared to himself. The test fulfills all requirements.
Pham Duc Tri Grade 5 Schoolwork: Appendix Figure 6.3 Score: 7.5/10	He adjusted his speech and focused on the lesson (reducing rambling, out of focus) He maintains a positive learning attitude.	He presents a cleaner presentation and argues more rigorously. His academic results are better than his own. He fulfills the requirements well but there are still small errors in the calculation.
Nguyen Minh Tri	He had an interaction with the	He exchanges and interacts with

Grade 5 Schoolwork: Appendix Figure 6.4 Score: 5.5/10	teacher at the beginning of the class. He does his homework even though it's not enough. He has improved concentration.	teachers more. His ability to focus and reflexes is better. He's making progress with himself. The test meets the knowledge requirements, but not careful enough, so some data is wrong.
Luan Y Tran Grade 4 Schoowork: Appendix Figure 5.1 Score: 10/10	He interacts with teachers well and is excited to learn math. He knows how to ask questions to deepen the problem. He gave a different explanation from the teacher.	He maintains a positive learning attitude. He confidently presents his ideas. His parents rated the change very positively. The test meets all requirements.
Than Minh Tam Grade 4 Schoolwork: Appendix Figure 5.2 Score: 9/10	Her problem-solving speed and reflexes have improved. She does her homework and prepares well at home. She is more comfortable taking classes.	She can handle the problem faster (on time for the assignment). She interacts with the teacher more and feels happier in the classroom. The test meets all requirements. However, the work has small errors.
Duong Hong Minh Chau Grade 4 Schoolwork: Appendix Figure 5.3 Score: 8/10	She has reduced basic errors, started to form learning goals, and interacts with teachers better.	She was able to fix the basic mistakes when doing the test. She has clear learning goals and motivations. She is comfortable and wants to learn math.
Luong Ngoc Tram Grade 4 Schoolwork: Appendix Figure 5.4 Score: 6.5/10	She has reduced her fear of learning math. She recognized her own limitations and began to set learning goals.	She feels more comfortable and happy when learning math. She knows how to ask questions and answer the teacher.

CONCLUSION

Teaching specialized thinking manipulation helps students to be active in learning. Students construct their own knowledge. Students not only develop familiar thinking such as critical thinking, logical thinking but more importantly, students also develop creative thinking. Students appear more confident to participate in the teacher's series of problem-solving activities and actively participate in expressing opinions during class and enthusiastic in individual and group works. School-age is a special age. Psychophysiology has not been fully developed, their knowledge is not much, so our research and experimentation process is sometimes difficult. By making efforts to overcome those difficulties, we have succeeded in designing a teaching method that develops specialized thinking for students. We found that the students showed great interest in the way of teaching to develop specialized thinking. In particular, by surveying four cases with different levels of learning such as very good, good, fair, and poor, we found that the students all made remarkable progress and the next lesson had more progress than the one before. These things prove that this teaching method is feasible and has achieved the pedagogical purpose.

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