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Realistic mathematics education (RME) and didactical situations in mathematics (DSM) in the context of education reform in Vietnam

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Abstract. Mathematics Education plays a key role in the ongoing education reform in Vietnam, which commenced with the renewal of the curriculum and textbooks (from primary to secondary and high schools). In the world, Didactical Situations in Mathematics and The Realistic Mathematics Education have been widely and effectively applied in the Netherlands, America, France, Indonesia, etc. This article presents some cultural characteristics of Mathematics Education in Vietnam and the results of initial research on these two theories, providing some models of teaching situations and examples for pilot implementation, initial survey the ability to apply Didactical Situations in Mathematics in Vietnam, providing some suggestions for the renovation of Mathematics curriculum and textbooks in Vietnam at present.

1. Introduction

Mathematics is a science that arises, develops from real life and serves as a practical tools to solve reality problems. Therefore, it is necessary that mathematics teaching be linked with the reality in society as well as in learner's life. Hence, how mathematical teaching is linked to practice, what extent is appropriate in the context of mathematical education reform in Viet Nam, what adjustments are required in mathematics teaching are the questions that need investigating and resolving.

At present, the Ministry of Education and Training of Vietnam is organizing a major educational reform, commencing with the renovation of the curriculum and textbooks (from primary to secondary and high school). It is projected that in principle, there will be only one general education program in the whole country and possibly a range of textbooks, approved under the regulations of the Ministry of Education and Training. The general education curriculum after 2018 will be designated in the aim of developing learners' competencies. As explained by experts and the Ministry of Education and Training, the current program was designed in the direction of content development. In the context of general education curriculum reform, Mathematics curriculum also needs to be renovated towards learners' competency development. The researchers believe that this innovation should be implemented comprehensively in terms of objectives, programs, textbooks and teacher training.

This study focuses on the Theory of Didactical Situations or the Didactical Situations in Mathematics (DSM) and the Realistic Mathematics Education (RME) in order to propose some implications for the current reform of the mathematical education program in Vietnam.

2. Mathematics teaching in Vietnam in the context of education reform

2.1. Mathematics Curriculum and Mathematics Textbook after 2018 (MoET)

Maths Cirriculum Outcomes [10]: Mathematics Education aims to develop students core qualities; general competences, and mathematical competence with the core components of including competences of mathematical reasoning, mathematical modeling, Maths problem solving, mathematical communication, competence to use mathematical tools and media. Mathematics education also develops key knowledge and skills and creates opportunities for students to experience and apply Mathematics to real life. Mathematical education connects mathematical ideas, Mathematics and other disciplines, and Mathematics and real life. Mathematics education is conducted in many subjects such as Mathematics, Physics, Chemistry, Biology, Technology, Informatics, Experimental Activities, etc., in which Mathematics is the core subject.

In this study, we focus on proposing some implications for the development of the Mathematics curriculum in general, in the context of education reform in Vietnam. However, it is advisable to discuss the current teaching context in Vietnamese schools.

2.2. Systems of Vietnam Education

Vietnam education system is shown in the following diagram:

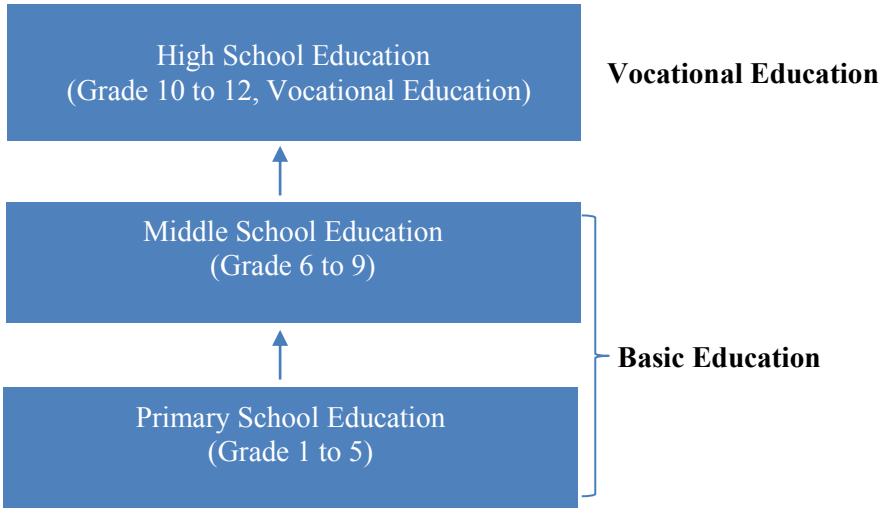

Figure 1. Vietnam education system

2.3. The role of Curriculum and Textbook

Teachers and students mainly use textbooks as the core materials in the classroom in teaching Mathematics

Mathematics textbook are divided into several chapters containing lessons and a mathematics lesson often has some formal mathematical definitions, theorems, regulations or formulae [8]. There is one series of mathematical textbooks in school despite the fact that students live in different regions [8]. However, there are some sets of books that are used exclusively in some elementary schools, or in some provinces, such as books for ethnic minority students (translated into ethnic minority languages), Maths book for students in some international schools (based on the international curriculum, in parallel with the current textbook).

Recently in the Math textbooks, there have been more real life related exericses, which is just somehow related to real life problems rather than actual real life ones. It is common that problems in Math textbooks are generated by modelling real life problems, in stead of examining the actual real life ones.

2.4. Classroom Organization

Teachers often spend much less time on teaching concepts and theories, mainly focusing on teaching rules, methods, and problem solving skills. This is primarily because current assessment tools mainly focus on testing basic knowledge and skills of the lessons in textbooks through solving exercises. At present, in order to approach the new cirriculum, in the test of some schools, some Departments of Education and Training have included Math questions that require students' application to other subjects, to reality or real life related situations (in end-of-term, end-of-year or entrance exams at all levels).

According to Le Tuan Anh [8]. students usually have to take part in some extra-lessons to keep up with the curricula or pass examinations.

Mathematics lessons in the textbooks as well as examinations in schools offer few examples or applications relating to real life or real world [3]. Vietnamese students often struggle to apply mathematical knowledge in reality [8].

In spite of some changes in the content of mathematic textbook, a formula or a theorem is often presented as follow: +) Step 1: Content of a formula or a theorem; +) Step 2: A proof of the formula or theorem; +) Step 3: Application of the formula or theorem in some pure mathematics examples. Similarly, a concept is often performed as follows: +) Step 1: Definition; +) Step 2: Some examples of the concept; +) Step 3: Characteristics [8].

Although there have been various changes in the practice of mathematics teaching these days, some following situations are still common: 1) The teacher mainly imparts content and knowledge, pupils learning by the examples; 2) The majority of teachers generally prefer explanations, lectures and samples with frequent incidental questioning; 3) The teachers are not monitored, they do not help pupils to create problems and 'occupy' new knowledge [3]. 4) Mathematics teachers usually use 'training for exams' method to help their students carefully practice forms of problems which usually appear in examinations; 5) One 'real goal' of teaching mathematics in school is to help students score higher on examinations [8]. The second situation greatly affects Mathematics teaching and learning.

A session usually lasts 45 minutes, while a lesson from one to three or four hours. It is up to teachers to appropriately adjust the teaching content (up to 30% different to the original subject teaching schedule) and lesson plans. However, the motivation for innovating teaching content and techniques is not high and popular so teachers tend to closely comply with the prescribed teaching content distribution (according to the regulations of the Ministry of Education and Training).

Mathematics teachers usually use pieces of chalk, one blackboard, ... and students have the specific desk in the classroom for semester or school year [8]. Teachers sometimes use overhead projectors, computers, beamers, videos and other tools for their teaching in case of the good teacher contest.

In the primary classroom, contrary to the description of the secondary classroom that "*students do not have the chance to play games, which can help them to learn mathematics*" [8], students often play at least one game in each Mathematics lesson.

At present, more and more primary and secondary students want to participate in the Maths Competition in English language organized by national and international organizations, for example, International Kangaroo Math Contest (Contest-kangaroo-math.vn), Violympic online (violympic.vn), International Mathematics Assessments for schools (imas.ieg.vn), etc.

3. Research questions and method

The research questions are:

- Is it possible to combine and apply the DSM and RME theories in the process of reforming Mathematics education in Vietnam?
- Can Vietnamese students learn Mathematics based on models and examples of applying these two theories in Mathematics teaching?

To answer the two above questions, we studied about DSM and RME, developed some models of Maths teaching situations by combining the research results on the two theories, proposed some

examples (some teaching situations) relevant to the Vietnamese cultural and practical context. The research was then conducted using the proposed teaching situations in order to give some initial recommendations for the application of the two theories in the process of reforming Mathematics education in Vietnam. These situations were employed to teach some groups of students (140 students at 12th grade in some high schools) in some provinces including Bac Giang, Thai Nguyen, Hai Duong, Hanoi. The findings help us to make an initial evaluation of the effects or obstacles in promoting mathematical education in practice in the context of Vietnam.

To access the student's compentence and readiness to learn Mathematics in practice and by practice, in each situation, we provided a work sheet with the given tasks for students, which were then collected and evaluated in terms of: ability to recognize and identify the situational tasks and Maths problems; Maths modeling compentence, the ability to solve the modelled problems and compentences to apply knowledge and make the conclusion in the real life contexts. The statistics of the number of students who could solve the tasks and the degree of completion of the tasks allow us to find out the outstanding tendencies and difficulties in teaching Maths in connection with real life among Vietnamese high school students. The analysis of some typical answers to the assigned tasks partly helps to determine the level of students' task achievement and the difficulties in certain contexts. Subsequently, it helps to identify the cause of those difficulties. Hopefully, we then may propose suitable recommendations for teaching Mathematics in the current context of Vietnam.

4. A brief overview about Didactical Situations in Mathematics and Realistic Mathematics Education

4.1. Some basic concept in Didactical Situations in Mathematics

The theory of Didactical Situations is stated by the psychologist, educationalist Guy Brousseau. Subsequently, a variety studies created a school called Didactical Situations in Mathematics.

In this school, knowledge is constructed in various forms. According to Guy Brousseau [6], stated knowledge is usually "hidden the "true" functioning of science, which is impossible to communicate and describe faithfully from the outside, and replaces it with an imaginary genesis", and, "to make teaching easier, it isolates certain notions and properties, taking them away from the network of activities which provide their origin, meaning, motivation and use. It transposes them into a classroom context. Epistemologists call this didactical transposition.", and to have effective teaching, the production and teaching of mathematical knowledge requires an effort to transform this knowledge into institutionalized knowledge, a depersonalization and a decontextualization that tend to blot out the historical situations which had presided over their appearance.

There are two main important concepts: adidactical situation and didactical situation. In the process of teaching, the teacher need to provoke the expected adaptation in her students by a judicious choice of problems that she puts before them. These problems, chosen in such a way that students can accept them, must make the students act, speak, think, and evolve by their own motivation. Between the moment the student accepts the problem as if it were her own and the moment when she produces her answer, the teacher refrains from interfering and suggesting the knowledge that she wants to see appear. Not only can she do it, but she must do it because she will have truly acquired this knowledge only when she is able to put it to use by herself in situations which she will come across outside any teaching context and in the absence of any intentional direction. Such a situation is called an adidactical situation. Each item of knowledge can be characterized by a (or some) adidactical situation(s) which preserve(s) meaning. In the adidactical situation, teacher's specific intentions are hidden and students can function without teacher intervention. We can say that in the learning process, students face to face the adidactical situation with the support of teacher is the context of didactical situation.

Discussing the learning process, Brousseau said that: Knowing mathematics is not simply learning definitions and theorems in order to recognize when to use and apply them [6]. And the work of

teacher is imagining and presenting to the students situations within which they can live and the knowledge will appear as the optimal and discoverable solution to the problems posed.

And these are three types of situations called situation of action; situation of formulation (or situation of communication); situation of validation. These situations is presented clearly in the famous example the game "the race to twenty" which created by Guy Brousseau. The Situation of action lays the essential foundation for the explicit models and formulations which follow. The Situation of action provide feedback to the student on which to base, and against which to test, his models. In general, formulation occurs in Situations where the student has a certain amount of information, but either needs more information than she can come up with on her own or does not have the means of taking action on her own, and in order to proceed must communicate with other members of the class. If the groups become argumentative, the next Situation may develop while the group planning sessions are going on. In any case, it will do so in the following one. This is the Situation of validation.

4.2. Realistic Mathematics Education

The Realistic Mathematics Education (RME) developed by the Freudenthal Institute is also known as "real-world mathematics education" [15]. RME aims at enabling students to apply mathematics. In RME, this connection to reality is not only recognizable at the end of the learning process in the area of applying skills, but also reality is conceived of as a source for learning mathematics. Just as mathematics arose from the mathematization of reality, so learning mathematics has to originate in mathematizing reality. Van den Heuvel-Panhuizen, M. [17]. Even in the early years of RME, it was emphasized that if children learn mathematics in an isolated fashion, divorced from their experiences, it will quickly be forgotten and the children will not be able to apply it [4]. "In RME, mathematics is viewed as a human activity which connects mathematics to the reality. Reality refers to mathematics that is relevant to everyday situations and problem situation that are real in student's mind" [9]. And according to Lu Pien Cheng, the *real-life context problem* refer to problems embedded in real life situations that have no ready-made algorithm [9].

According to Freudenthal, mathematics was not the body of mathematics knowledge, but the activity of solving problem and looing for problems, and, more generally, the activity of organizing matter form reality or mathematical matter – which called "mathematizing" [4]. And he clarified what mathematics is about: "There is no mathematics without mathematizing" [4]. So the teacher need to find out the context, create the context which support student to construct mathematics knowledge. There are some suggestions for teachers find and create contexts for mathematics teaching: context in history of mathematic; context in real life (primary students' life: games, shopping, saving and using money, film,...; social issues: traffic, weather forecast, lottery, ...); integrated education (mathematics in Physical, Chemistry, Informatics Technology, etc.).

It is possible to point out some crucial principles in the studies of Mathematics teaching in the light of RME:

- *+) Activity Principle*: The learner is considered as an active subject in the teaching process whose their activity is the key factor to the outcome of this process. Therefore, the best way to learn Maths is by *solving* Maths problems;
- *+) Reality Principle*. Learners must be able to apply Mathematics knowledge to solve practical problems and mathematics education *should start* from meaningful practical situations with learners to give them opportunities to cooperate those meanings into the mathematical structures in their minds.
- +) *Level principle:* emphasizes cognitive development through various levels of mathematical learning: from non-mathematical contexts involving knowledge, through symbols, diagrams, to pure mathematics content of knowledge. *Models* are very important as a bridge between informal experiences, the mathematical context involved, and pure mathematical knowledge. The models here can be understood as mathematical modeling.

- *+) Intertwinement principle:* Learners are placed in a variety of situations in which they may perform various types of tasks intertwined (reasoning, calculating, statistics, algorithms conducting, etc.), using a lot of Mathematics knowledge and tools from different disciplines, even other sciences.
- *+) Interactivity Principle:* encourages interpersonal and group activities to create opportunities for individuals to share their skills, strategies, discoveries, ideas, etc. with other learners. In return, they can benefit from others for cognitive and personal development.
- *+) Guidance Principl*e is described as a process of guided reinvention in mathematics instruction. Specifically, teachers need to design scenarios or situation (or context) that are potentially rich in activity, of which the implementation can create meaningful cognitive leaps for learners.

5. Some recommendations for teaching mathematics in the direction of RME and DSM

5.1. Renovating the maths teaching program in direction of RME and DSM by designing appropriate teaching situations

From the conceptual and theoretical analyses of the above-mentioned mathematical schools, we believe that in their classrooms, teachers can innovate the teaching programs by designing teaching situations as follow.

The teaching situations employed here are not necessarily derived from the DSM perspective. Every teaching situation, designated by combining the approach of the two theories, fulfils the following requirements:

Each situation is a dual context consisting of two interlocking contexts: a knowledge context designed by the teacher (the context in which the students handle a performance task, and the knowledge discovering requirement may not be explicit); and the second context is a classroom setting with teacher - student interaction with cultural relevance and adaptability.

Each situation must include all the basic types of situations as described in the DSM: situation of action, situation of communication and situation of validation.

Each situation is designed to be either started or terminated in practice, in one of the four following type of situations.

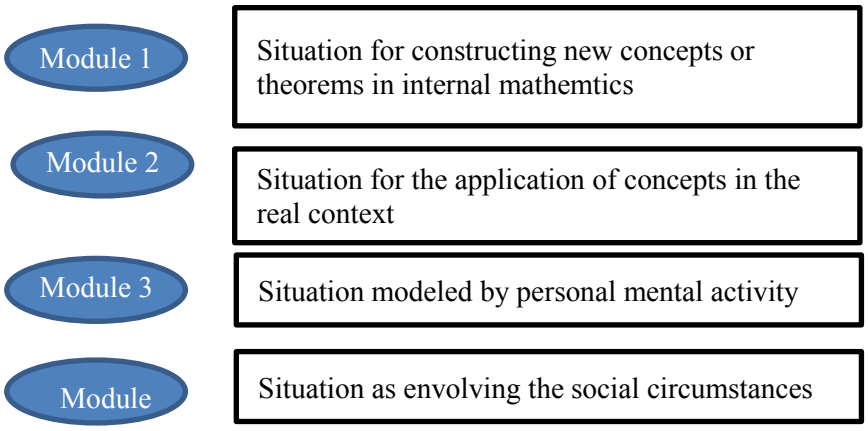

Figure 2. Some types of Maths teaching situations

5.2. Examples of some teaching situations and assessments of students' compentences through teaching situations

5.2.1. Some example of teaching situations.

Situation 1 (Model 2). Your school is organizing a sport games, and you are assigned to work as a coach of triathlon. The athletes are required to swim and run from point A to point B is as shown in the figure below. The swimming speed is 1.6 m/s, the running speed is 4.8 m/s and the distance between the two banks AH = 200 m, HB = 1000 m. Advise the athlete the best strategy for the situation.

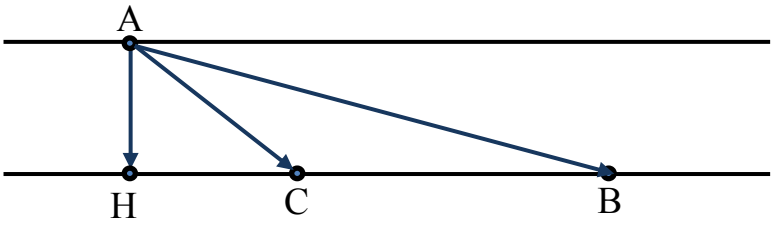

Figure 3. The athletes are required to swim and run from point

Perform the two following tasks:

- *Task 1*. Describe possible ways to perform the athlete's task.
- *Task 2.* What is the best way to perform the task? Why?

Situation 2 (Model 2). The water wheel is a device of Vietnamese farmers in the mountainous North Westhern region. Its shape is formed by a reel, which is a large wheel with the five meter diameter. The rotating axis is made of solid bamboo trunk with hundreds of "spokes", forming a stable frame for the water reel. The reel rim is about 80 cm wide, with the nests in place to halt the water to creat a thrust of the treadmill, and the inclined tentacles tied up with an angel of about 30 degrees. Connected to the water wheel is often the gutters leading back to local houses or fields, often made from the half-spilt bamboo trunk. Each water has 40 bamboo tentacles, each tube is 60 cm in length, 20 cm in diameter, of which the shell thickness is about 1 cm.

Figure 4. water wheel

Let's do the following two tasks:

- *Task 1:* Explain how the water wheel in the above figure can collect water?
- *Taks 2:* How many rounds does the water wheel rotate to collect enough water for the pool with 3 m^3 in capacity?

Situation 3 (Model 4). Here is the rules and prizes of Vietlot (a new form of digital lottery in Vietnam).

Rules:

1. Playing one line of numbers: Players select 6 out of 45 numbers (from 01 to 45) to form a line of numbers to play.
2. Playing multiple lines of numbers:
   - Players choose 5 numbers from 01 to 45 (bao 5), the sixth number will be selected randomly by the software system from the remaining 40 numbers, which will form 40 lines of numbers. Compare your lines with the winning one in the selected draws to determine the prize.
   - Players select 7 numbers (bao 7) to 15 numbers (bao 15) or 18 numbers (bao18) from 01 to 45. Then, the software system helps players create all 6-digit combinations from the selected numbers to form the lines of numbers to play.
3. Playing in multiple draws: Players select the draw and are entitled to play in up to 6 consecutive draws. In each draw, there are 4 prize tiers and there is 1 draw in each prize drawing session to select a winning line of numbers composed of 6 number from 01 to 45.

Prizes

- Playing one line of numbers: (Players select 06 numbers to form a line of numbers). Each draw ticket costs 10,000 VND.
- Playing multiple lines of numbers: Draw ticket cost: (10,000 VND per play, multiplied with the number of selected lines).

Table 1. Rules and prizes of Vietlot (a new form of digital lottery in Vietnam)

MEGA 6/45			
Prize Categories	Matching numbers	Prize) VNĐ(	Projected prize proportion
Special Prize	●●●●●●	Minumun 12 billions VND and added value	41.31%
First Prize	●●●●●	10,000,000	2.87%
Second Prize	●●●●	300,000	4.09%
Third Prize	●●●	30,000	6.73%
	Total		55.00%
Note :● is the matching number with the winning line, in any order.			

In the case that a winner's tickets win multiple prizes, the winner will only be awarded with the highest prize. In case there are multiple winners of special prize, the special prize is shared in proportion with the winners' ticket values. As for the First to the Third Prize, the prize value is calculated by the number of draws (each draw ticket costs 10,000 VND) multiplied with the prize value in each draw.

Question 1. Calculate the probability of winning special prize and other prizes when playing Vietlot.

Question 2. Analyze the advantages of the two current lottery types (the traditional National and Provincial Lottery and Digital Lottery Vietlot). Advise lottery players the more favourable type of lottery and the optimal playing.

Question 3. Study some international types of lottery that you know and compare with the lottery types in Vietnam in terms of prizes, winning ratio and other aspects.

Question 4. Why do people like playing lottery? Are playing lottery and lotto betting (Lô-Đề) is an important and even indispensable human's need? Why did the lottery company launch the digital lottery Vietlot in the South of Vietnam?

Question 5. Select and do one of two following tasks:

1. If you are a lottery advocate, write a paragraph that analyzes its advantages reminds players about the pitfalls objectively and scientifically;
2. If you are an opponent of lottery playing, write a paragraph that analyzes the disadvantages and advantages objectively and scientifically.

Question 6. If you were an investor, which lottery company would you choose invest between these two type of abovementioned lottery?

5.2.2. Findings and discussion

Situation 1

Task 1. All the students were able to describe some of the strategies to carry out the given task. However, all the proposes solutions included: swimming from A to H then running to B; swimming from A to C and then running to B, in which the point C was identified mainly on the drawing without any special features; or swimming straight from A to B.

Task 2. All the test takers failed to fulfil this task. Most of the assignments submitted were either incompleted or incorrect using their backdground knowledge of planar geometry (Figures 5., 6., 7., 8. below). In other words, many of the student's assignments focused on composing the images to work out the shortest distance. As a result, students neglected the spped when calculating the swimming or running time. Thus, students can not perform the modelling task, which means they failed to transform the situational task into a Math problem.

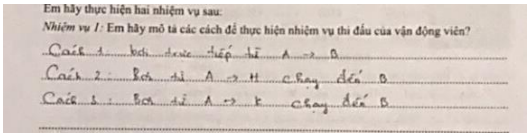

Figure 5.

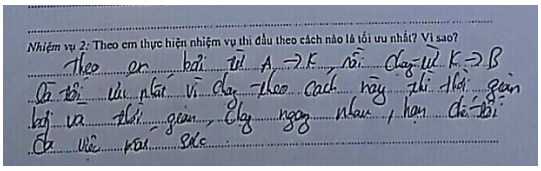

Figure 6.

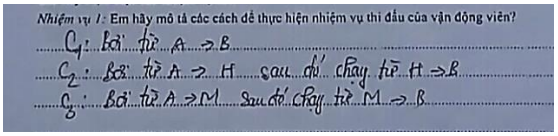

Figure 7.

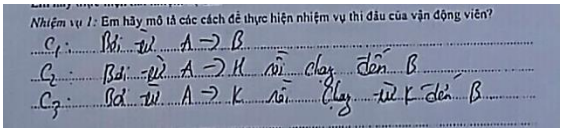

Figure 8.

Moreover, two proposed solutions to the task were revealed included: either figuring out the shortest path by drawing the diagram first and then calculating the required time in that scenario (Figure 9.), or pointing out some possible scenarios in the diagram, then calculating the time under each circumstance, then selecting the option with the shortest time (Figure 10.).

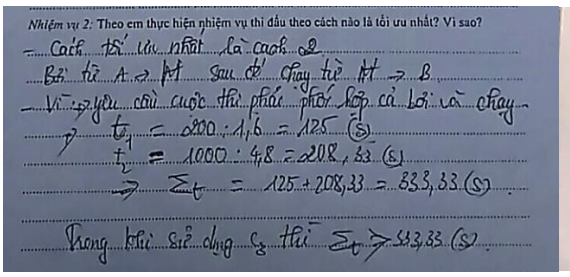

Figure 9.

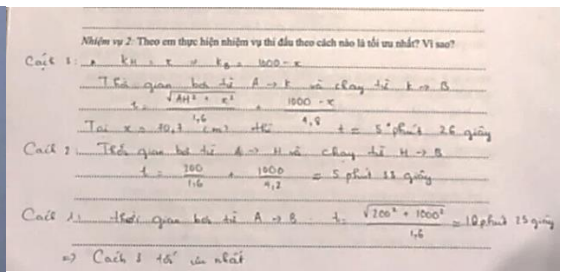

Figure 10.

It is shown that all 12th graders in this survey were not be able to model the situations, and of course failed to solve the problems in the given context. In addition to the above mentioned reasons, their teachers also said that students were not familiar with such Maths tasks due to the lack of proper practice with that task type. Moreoever, students are not motivated enough to solve those practical Maths problems as these problems are not included in important examinations.

Situation 2

Task 1. Many students could not explain how water could be collected. A clear and well-structured explanation as in figure 11. below is quite rare.

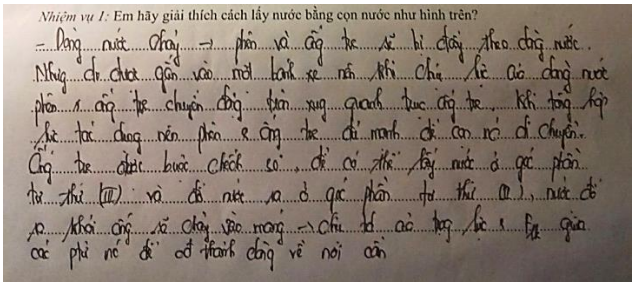

Figure 11.

Task 2. Many students can not relate or refer to calculating the capacity of water in the inclined tube rather than the filled tube. Thus, many students couldn't explain how to collect the water because they made mistakes by calculating the full capacity of the tube rather than considering all the factors in the real situation (Figure 12, and Figure 13).

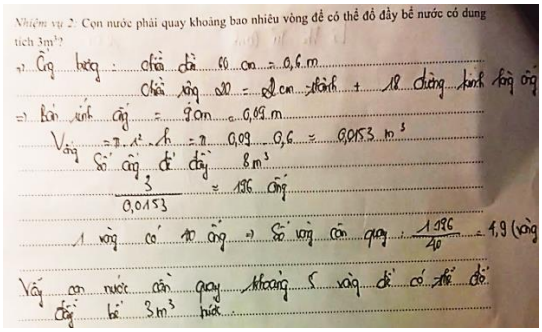

Figure 12.

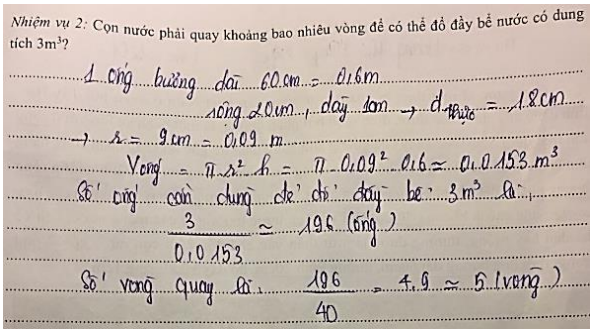

Figure 13.

The given task is considered an interesting, yet challenging one. Unfortunately, in reality, it turned out to be such a huge challenge with all student participants in the research that all of them left the problem completely unsolved or failed to transform the situational task into a Maths problem. If they couldn't even understand the questions, it's certain that they couldn't answer it.

Situation 3

Question 1. Most students could not answer this question (by writing 'I don't understand.') or answer incorrectly. The reason identified is that although the instruction is very specific, the students still could not understand the rules of the game. Also, despite being given plenty of time, they still did not try asking any lottery agents or players to understand the rules of the game. Thus, they failed to model the situation in the task using their own understanding of the lottery rules, which affects the subsequent questions.

In all the students' answer sheets, only one worksheet was found with the correct answer to question 1 as shown below (Figure 14). However, as the answer was too brief, we conducted an interview to ask the student about the way he did it. It was found out that the student understood the question, the rules of the lottery game as well as the basic concepts such as accordance, combinations or permutations and managed to apply them.

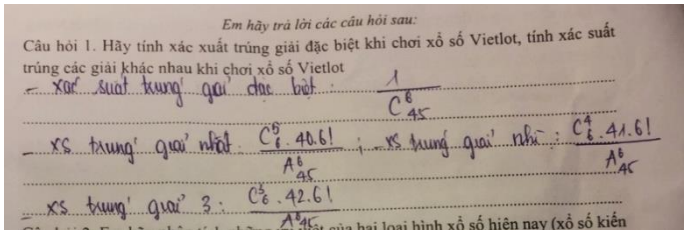

Figure 14.

Question 2. Because many students failed to answer Question 1, very few students succeeded in answering this question correctly. Some students still answered question 2 without answering Question 1 (Figure 15.). Interestingly, they all gave the same advice which was not to play, because the winning ratio of the lottery in Vietnam was too small. Another interesting finding is that when asked about the playing strategy, they all replied "do not play" (Figure 15.), and if you play, you should choose Vietlot (Figure 16.).

On the other hand, we also see the unclear rules of the game in the answer of a student to the first question when he wrote that Vietlot's special prize is 12 times worthier than the special prize of the tradition Northern Lottery (Figure 16.). This is not true. The students could not project the cases of multiple winners and did not know how to calculate the unstated prize of Vietlot.

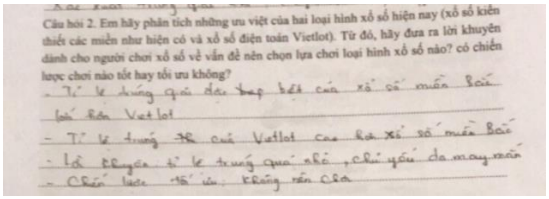

Figure 15.

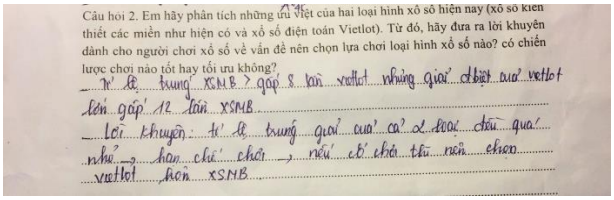

Figure 16.

Question 3. Collecting some answers like "I do not know", "Most lottery types are similar because the winning chances are very small", ... (Figure 17., Fig. 18.), we followed up by asking the students in person what lottery types they refered to with "most". It was revealed that the students were aware of neither the rules of both lottery games mentioned in the task nor those of other types. When being asked, "Did you use the Internet to search for the rules?", all students answered similarly "no" or "I did not think of that way". This points out the lack of practical knowledge and skills and the habit of using the internet as an important searching engine. Although Internet-connected PC and smart phones are widely available with many students, they still haven't got this habit and competence.

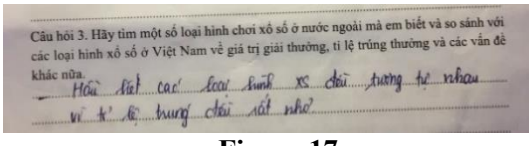

Figure 17.

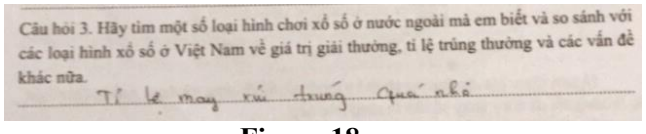

Figure 18.

Question 4. With this question, although students could not provide complete answers, the submitted ones were quite satisfactory. They are expected to study and discuss the belief in "good luck" as well the the subtle distinction in the culture and lifestyle between Northerners and Southerners in Viet Nam regarding playing lottery. Students were able to partially explain the reasons for playing the lottery (such as "want to spend less, get more" (Figure 19., Figure 20.) and the difference in lottery players' behaviour in the North and the South. For example, they mentioned that Southerners do not have the habit of saving as the Northern people (Figure 20.). All the answers we collected stated that playing the lottery is not an essential need.

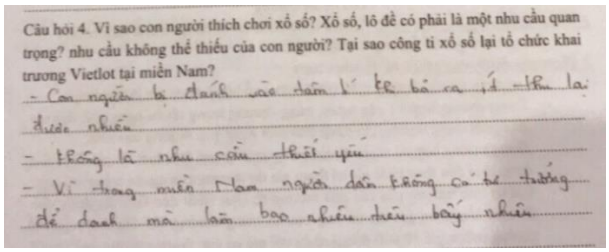

Figure 19.

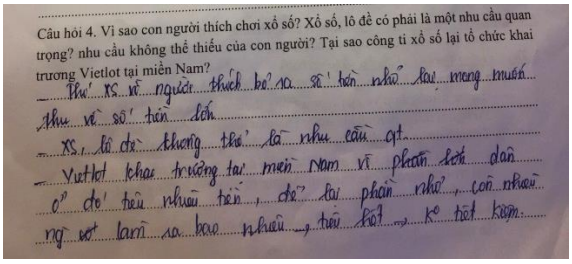

Figure 20.

Question 5. There were very few answers to this question. All the submitted answers warned people against playing lottery given the explanation that "the chance to win is too small" (Figure 21., Figure 22.) and the money spent would be much more than the amount earned (Figure 21.). Interestingly, there was a student who compared the lottery with lotto betting - a form of illegal gambling based on the daily results of the official lottery draw- and stated that the chances to win in lotto betting might be much stronger!

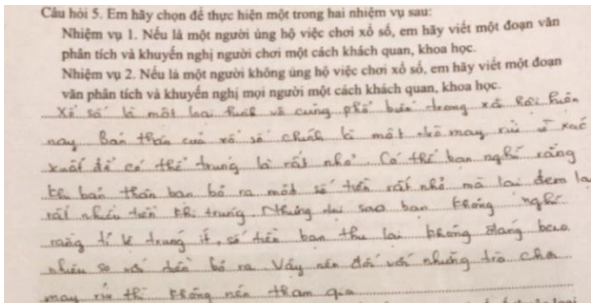

Figure 21.

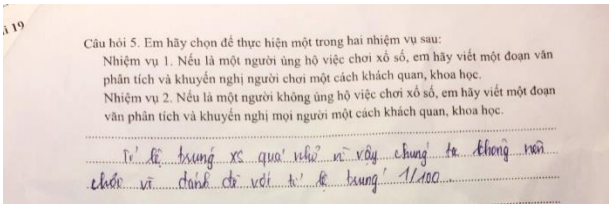

Figure 22.

Question 6. Most of the students choose Vietlot as the investment plan but they could not explain their choice. When we interviewed some students, they still did not point out specific or convincing justifications for their option (Figure 23.). Their answers even implied the misunderstanding between investing in lottery companies and investing in playing lottery. (Figure 24.).

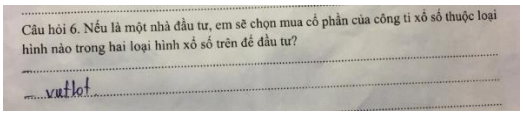

Figure 23.

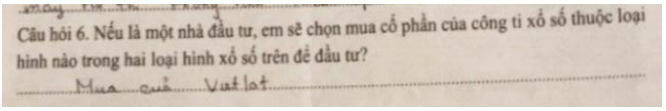

Figure 24.

6. Conclusions and recommendations

In all the situations mentioned, the students were always given plenty of time, not only in class but also independent self-study time. The knowledge we asked is just basic knowledge rather than complex knowledge, which requires complex mathematics transformational techniques or belongs to the field of probability and requires derivatives to identify the maximum and minimum values of the functions. However, the findings of the initial research point out various concerns about the students' competence to apply mathematics into practice including:

1) Students have not yet adapted to the proposed Maths task types as well as the organising methods of practical learning activities.
2) Students are not proactive in exploit relevant information in Maths problems, in life when encoutering new task type and knowledge they are familiar to in school.
3) Students' reading comprehension is generally limited;
4) The given contexts have not been fully and profoundly exploited and examined by the students.

5) Student's modelling competence is not adequate.

Therefore, we would propose some recommendations for developing the mathematics cirriculum as follow:

1) It's crucial that the Maths cirriculum take into account and introduce the requirements and regulations for developing learners' modeling compentence in a more practical way. In the context of Vietnam, the Mathematics program needs to be designed in a more open and practical way. One solution would be learning from the effective international Maths cirricula in other countries such as the Netherlands, USA, Singapore or Indonesia;
2) In the Vietnamese context, the implementation of school curriculum and classroom programs needs to be more flexible to further promote the teachers' creativity in designing classroom or school programs more effectively and progressively;
3) It is necessary to consider and systematically innovate assessment methods in major mathematics examinations throughout the school year or provincial and national examinations in the aim of assessing learners' modeling competence and reading comprehension ability because assessment form and content play an important role in exam preparation and teaching and learning methods.
4) Maths teachers need to update their teaching content in the direction of enhancing the application and connection of Maths knowledge and real life in order to to help students use Mathematics and realise the significance of Maths;
5) It's necessary to develop of students' reading comprehension ability in teaching Mathematics.

References

[1] Baker E L, O'Neill H F and Linn R L 1993 *Policy and Validity Prospects for Performance-Based Assessment* (Am Psychol vol 48) pp 1210-1218
[2] Bennett J, Lubben F and Hogarth S 2007 *Bringing Science to Life :A Synthesis of the Research Evidence on the Effects of Context-Based and the Science-Technology-Society Approaches to Science Teaching* (Science Education vol 91) pp 347-370
[3] Do Dat 2000 *Mathematics teaching and learning in Vietnam* (International Journal for Mathematics Teaching and Learning) Retrieved on December 15, 2005 from *:* http*//:*www.cimt.plymouth.ac.uk/journal/
[4] Freudenthal H 1968 *Why to teach mathematics so as to be useful* (Educational Studies in Mathematics vol 1) pp 3-8
[5] Gilbert J K 2006 *On the nature of* "*Context* "*in Chemical Education* (Intenational Journal Science Education vol 28) pp 957-976
[6] Guy Brousseau *)*2002 *.(*Theory of Didactical Situations in Mathematics (Kluwer Academic Publisher)
[7] Kamaliyah, Zulkardi and Darmawijoyo 2013 *Developing the Sixth level of PISA-Like Mathematics Problems for Secondary School Students* (Indonesian Mathematics Society, Journal on Mathematics Education vol 4) chapter 1 pp 9-28
[8] Le Tuan Anh 2006 Applying Realistic Mathematics Education in Vietnam :Teaching middle school geometry (Dotoral Thesis, Institutional Repository of the University of Postdam)
[9] Lu Pien Cheng 2013 *The disign of Mathematics Problem Using Real-life context for Young Children* (Journal of Science and Mathematics, Education in Southeast Asia vol 36) chapter 1 pp 23-43
[10] MoET 2017 *National general Education Curriculum –Overall curriculum.*
[11] Ngo Vu Thu Hang 2016 *Context-Based Education :An Advanced Approach* (Journal of Science, Educational Research vol 32) chapter 3 pp 11-17
[12] Nguyen Tien Trung, Hoang Ngoc Anh and Nguyen Duong Hoang 2017 *Constructivist teaching in Vietnam mathematics class :A case study of teaching equations of straight lines in the plan*

)*Geometry Grade 10th – High School, Vietnam ((*The European Journal of Education And Applied Psychology vol 4) pp 41-51

[13] Reudenthal H 1973 *Mathematics as an Educational Task.* (Riedel Publishing Company, Dordrecht, The Netherlands)

[14] Van den Heuvel -Panhuizen M 1996 *Assessment and Realistic Mathematics Education* (Utrecht :CD-Beta Press)

[15] Van den Heuvel-Panhuizen M 2000 *Mathematics education in the Netherland :A guided tour* (Freudenthal Institute Cd-rom for ICME9 .Utrecht :Utrecht University)

[16] Van den Heuvel -Panhuizen M 2003 *The didactical use of models in Realistic Mathematics Education :An example from a longitudinal trajectory on percentage* (Educational Studies in Mathematics vol 54) chapter 1 pp 9-35

[17] Van den Heuvel-Panhuizen M 2005 *The role of contexts in assessment problems in mathematics* (For the Learning of Mathematics vol 25) chapter 2 pp 2-9; 23

[18] Vu Dinh Phuong 2014 *Using Video Study to Investigate Eighth-grade Mathematics Classroom in Vietnam* (Dotoral Thesis, Institutional Repository of the University of Postdam)