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Teaching Mathematics Based On "Mathematization" Of Theory of Realistic Mathematics Education: A Study of the Linear Function Y=Ax+B

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----------ABSTRACT----------
Theory of Realistic Mathematics Education (RME) was originated in The Netherlands in 1970. It was developed from Freudenthal' point of view which considered mathematics as human activity. This theory suggested that teaching mathematics should begin with realistic context; the teacher guides his students to reinvent knowledge by process of mathematization. In this paper, we present our research results obtained from application of RME into try-out of teaching linear function in Vietnamese schools
Keywords: *Linear function, mathematics education, realistic mathematics education, RME.*

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I. INTRODUCTION TO RME

Theory of "Realistic Mathematics Education" (RME) was developed from idea on mathematics education of H. Freudenthal when he considered mathematics as a human activity; from which the RME determined two key concepts: guided reinvention, and mathematization as its fundamental concepts [2]

- *Guided reinvention:* mathematics education should be the process of reinvention in which the students acted as a mathematician to acquire mathematics knowledge (see Figure 1).

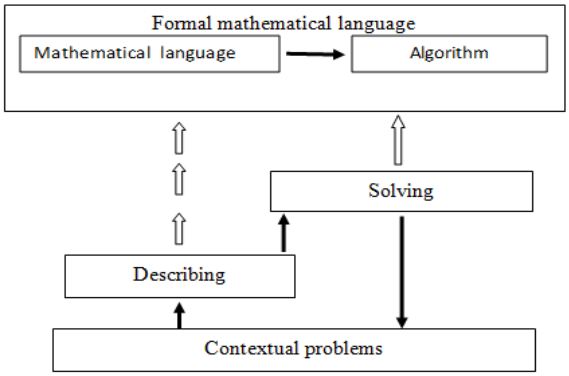

Figure 1. Guided reinvention model (Gravenmeijer, 1994)

- *Mathematization:* Mathematizing refers to the various ways of organizing activities in order to exhibit characteristics of mathematics, such as generality, certainty, exactness and brevity. In 1991, Freudenthal made a distinction between horizontal and vertical mathematization [2]. In horizontal mathematization, the students use mathematical tools to organize and solve a problem set in a realistic situation. Vertical mathematization is the process of reorganization within the mathematics discipline. Thus "horizontal mathematization involves going from the world of life into the world of symbols, while vertical mathematization means moving within the world of symbols." (see [2]) But he shows that the difference between these two types is not always clear cut. [2].

II. PURPOSE OF RESEARCH

In Vietnam, the linear function is in the curriculum of mathematics for 9th grade students. The problem is that this function could be taught according to theory of RME or not. In order to answer the above problem, we conducted the research with following questions:

The first question: In textbook "Mathematics 9", how does the concept "linear function" present?

The second question: From contextual problems of linear function, could students identify linear relations between two variables?

III. METHODOLOGY

Content analysis: We analyzed the content of the concept of linear function in the textbook "Toán 9" (Mathematics 9) [1] in order to know what the authors' point of view on mathematics education is.

Test of students' ability: In order to evaluate students' ability to identify a linear relation in contextual problems, we designed two contextual problems (Task1 and Task 2) and Task 3 according to theory of RME as follows:

Task 1: Given real – life situation in which has the relation of y = 200000x. Ask students for finding out this relation. (see Appendix)

Task 2: Given real – life situation in which has the relation of y = 3000x +5000. Ask students for finding out this relation. (see Appendix)

Task 3: From the two above problems, we asked students for making generalization of the relations which they identified. (expected answer: y =ax+b)

It is possible to recognize that Task 1 and Task 2 are at the level of horizontal mathematization and Task 3 is in vertical mathematization.

Participants: 69 students surveyed have just finished Mathematics 8 (8^{th} grade curriculum of mathematics in Vietnam). (See Table 1). These students have not yet learned the concept of linear function.

Table 1: Information about participants

School	Class	The number of students
THCS Thuận An (Hậu Giang)	8A1	36
THPT Hòa An (Hậu Giang)	8A1	33
Total		69

IV. RESULTS AND DISCUSSION

For the first question

The textbook Toán 9 (Mathematics 9) introduces the concept of linear function as follows:

"1. T**he concept of linear function**

"**Problem**: A bus from the South Hanoi Bus Station to Hue with average speed is 50 km per hour. After departing t hours, how far (in km) is the bus from the center of Hanoi? Given that the South Hanoi Bus Station is located 8km far from the city center."

1. Fill in the blank (…..) with the correct numbers:
After an hour, the bus can run: …
After t hours, the bus can run: …
After t hours, the distance from city center of Hanoi to bus is: s = …

2. Calculate the corresponding values of s when t gets the values 1 hour, 2 hours, 3 hours; 4 hours…respectively, then explain why s is a function of t?"

Definition

A linear function is the function given by the formula y = ax + b, where a, b are given numbers and a ≠ 0."

Comment: The Vietnamese authors of textbooks applied realistic points of view of mathematics education into

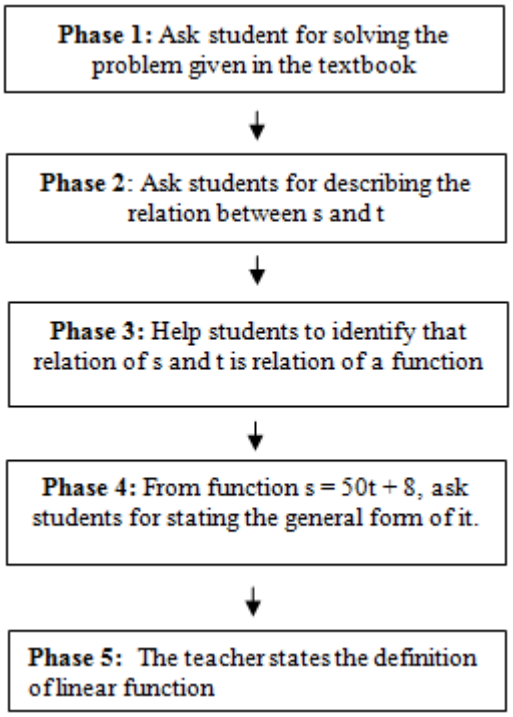

Figure 2. The process of teaching linear function under RME

teaching mathematics in schools. Before introducing a concept of mathematics to students, they offered a contextual problem relating to the concept. After solving the problem, students recognize a mathematical idea which they will learn. In our opinion, in process of teaching the linear function, the teacher can make use of materials of textbook to introduce the concept of function $y = ax + b$ by mathematization as the diagram in Figure 2. According to RME, Phases 1 is the contextual problem, and Phase 2 and 3 are in the stage of horizontal mathematization and Phases 4 and 5 are in the stage of vertical mathematization.

For the second question

Table 2. Students' results of the answers to tasks given

Students	Task 1	Task 2	Task 3
The number of students gave the true answers (%)	100 %	71 %	78.26%

Basing on students' results of the answers to tasks given (see Table 2), we could conclude that mathematizing ability of students has got at high level. From this investigation, we think that the teacher can apply RME to teach the concept of linear function to Vietnamese students

V. CONCLUSION

From the results of this study, we believe that Vietnamese students in schools can learn ideas of mathematics through solving contextual problems. Therefore, mathematics teachers of Vietnamese schools can apply theory of RME to teach mathematics contents in order to help students recognize the close relationships between abstract mathematics and realistic world.

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APPENDIX

1.

Gọi :

x (tấn) là _____ ,

y (đồng) là _____ .

Ta có: $y =$ _____ .

Gọi

x (giờ) là thời gian sử dụng dịch vụ Internet ở *phòng máy lạnh*:

y (đồng) là _____ .

Ta có: $y =$_____ .

2. Dạng tổng quát của các công thức tính y theo x trong các ý a), b) là $y = f(x) =$ _____ .