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Solutions for Mathematics Language of Elementary Students

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Abstract---*Mathematical language is a form of communication during the process of teaching and researching the major. Developing mathematical language for primary school students is an essential mission as an initial impetus to help learners get acquainted with the subject. The study objective focuses on evaluating the effectiveness of the proposed measure of mathematical language development for primary school included in the research content. The research methodology is based on the research conducted from September 6, 2018 to October 25, 2018 at Thach Khoi Primary School, Hai Duong city, which consists of 75 students in the experimental group and 80 students in the control group. The research used several questionnaires, tests, and in-depth interviews. Finally, the result showed that the proposed measures have created a deeper understanding of mathematics, more confidence, autonomy in learning for students and developing ability in overcoming psychological obstacles such as shyness, apprehension. In this way, learners can orientate logic coherently, clear expression, and have a long-term memory of mathematical knowledge. Meanwhile, for the students in the control group, there was no significant change in math language, and learning results were not upgraded.*
Keywords---*elementary students, language conversion, mathematical language, mathematical operations, primary school*

Introduction

In general, developing students' thinking is closely related to language maturing, including some basic communication skills: listening, speaking, reading, writing and combination activities (also whisper - an inner language or silent voice for answer preparation in word expression or sentences) (Goldhaber, 2006; Whitin & Whitin, 2000; Rothman & Cohen, 1989; Lin, & Yang, 2005). Language skills can only be developed through activities organized by pedagogical intent (Goldhaber, 2006; Hoang, 1994; Marijke et al., 2016). Therefore, in each hour of teaching Math, teachers need to construct lessons that purposely encourage students to perform the coordination of activities such as listening, speaking, reading, and writing in voluntary, or teacher and peer collaborations (Hornburg et al., 2018; Donlan et al., 2007).

The mindset of primary school students is still in the process of formation and development, "concrete thinking" stage so that they are completely shaped. Thus, the definition of concepts, symbols, rules establishment, and mathematical properties must be ensured that there is no excess or shortage, statements need to be brevity instead of a perfect theoretical overview. Temporarily, the description of that knowledge should be delivered through easy definitions or word explanations. As a consequence, this study aims to find appropriate ways to develop mathematical language for primary school students, thereby improving math performance results (Mantra, 2017; Mahayukti et al., 2017).

Research Methods

Research objectives

The purpose of the study is to evaluate the effectiveness of the measures proposed by the author to develop mathematical language for primary school students (Gomez et al., 2019; Wang et al., 1995).

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Period, research subjects

The study was conducted from September 6, 2018 to October 25, 2018 at Thach Khoi Primary School, Hai Duong City. The two groups examined have been assessed to perform almost the same mathematical ability (according to the input assessment report of the homeroom teacher and the expert group):

1) Group 1 (experimental group) includes classes 4A and 4B with a total of 75 students. In detail, Ms. Pham Thi Huong Thao is responsible for teaching in class 4A with 5 years of experience in teaching elementary math; Ms. Nguyen Thi Lien teaches class 4B with 8 years of experience.
2) Group 2 (control group) includes classes 4C and 4D with a total of 80 students; Ms. Dang Thi Minh Nguyet who leads class 4C, has 10 years of experience in teaching elementary math; Ms. Pham Thi Diu teaches class 4D with 8 years of teaching experience.

In addition, I also had in-depth interviews with some primary school math teachers to clarify the effectiveness of my proposed measure (Panagiotopoulou et al., 2004; Friso-Van den Bos et al., 2013).

Research content

The study evaluates the potential aspects of the author's solutions to develop mathematical language competence for primary school students. Those measurements are:

1) Suggestion 1: Organizing for students diverse and compatible language activities to help them utilize mathematical language (vocabulary, syntax, semantics) correctly in math concepts, and formation teaching.
2) Suggestion 2: Creating for students to perform language activities in compatible forms in order to develop learner's practice and apply accurate mathematical language then enhance memorization of mathematical rules, and properties.
3) Suggestion 3: Holding several language activities with problem solving for students.
4) Suggestion 4: Organizing for students to perform mathematical language activities by the practice of generalization ability.

Research process

1) Selecting experimental and control classes that are similar in terms of learning level.
2) Making a detailed plan for the experiment, clearly defining the things that need to be carried out: The purpose of the pedagogical experiment, the method of conducting, etc.
3) Examining thoroughly the subjects of pedagogical experimentation: dynamism, age psychology.
4) Orienting experimental lesson plans and then discussing experimental intentions with students and primary school math teachers so that they understand the focus of certain lessons. The control classes would be taught in the usual way.
5) Conducting experimental lessons in class 4A and class 4B; control teaching in class 4C and 4D at Thach Khoi primary school, second semester, 2016-2017 school year.
6) Driving interviews with students and teachers after study time to verify and gain experience from the application of proposed measures.
7) Delivering post-experiment tests to the two main groups of students, then analysing the results obtained, processing data and evaluating the effectiveness of measures affecting learning results as well as the level of students' mathematical ability.

Research orientation

1) Step 1: Arranging a meeting with primary school teachers to exchange and guide the way to implement the procedure applied in experimental lessons.
2) Step 2: Unifying the experimental plan and teaching content in the math program in grade 4; affirming with the experimental teacher about the teaching activities according to the researcher's preparation for the specialized content.

Total number of lessons: 19 lessons in the program with general exercises to foster mathematical language development for grade 4 students. In which:

1) Step 3: Carry out the teaching experiment. The experimenter attends, discusses, exchanges ideas and learns from experience together with the teacher after each lesson, to supplement and adjust the teaching lesson plan accordingly in order to achieve high efficiency.
2) Step 4: At the end of the experiment, carry out a discussion among the teachers in the faculty to discuss the issues experiment has pointed out.

Analyze and process data

We apply the mathematical methods of statistics in education sciences to process experimental data compared with the teaching methods in the control classes, as follows: Data processing, quantitative analysis to evaluate experimental results are operated according to the following formulas:

1) The average score of the tests (also known as the sample mean) is calculated by the formula:

$$\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i f_i$$

therein N is the number of tests students take, x is the score (on a scale of 10), f_i is the number of students who get score x_i, (also known as the frequency of points achieved by students).

2) Sample variance formula:

$$s^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2 . f_i$$

3) The formula for calculating the sample standard deviation (also known as the score dispersion around the mean):

$$s = \sqrt{s^2}$$

4) Use the t - student test to consider the effectiveness of the pedagogical experiment compared to:

$$t = \sqrt{\frac{\bar{x}}{S_{TN}}}$$

the t - student distribution table, if $t > t_\alpha$ we infer that the experiment has a significant effect.

5) Test variance and hypothesis H_0:
   a. Test variance by hypothesis E_0 *"The difference between the variances of the experimental class and the control class is not significant" with the quantity*

$$F = \frac{S_{TN}^2}{S_{DC}^2} .$$

   b. If $F < F_\alpha$, it confirms the same variance, we continue to test the hypothesis H0 "*The difference between the mean score of the experimental class and the control class is not significant with the same variance*" using the formula:

$$t = \frac{\overline{x_{TN}} - \overline{x_{DC}}}{s\sqrt{\frac{1}{n_{TN}} + \frac{1}{n_{DC}}}}, \text{ with } s = \sqrt{\frac{(n_{TN}-1)s_{TN}^2 + (n_{DC}-1)s_{DC}^2}{n_{TN}+n_{DC}-2}}$$

c. If $F > F_\alpha$, it confirms the different variance, we continue to test the hypothesis H0: "*The difference between the mean score of the experimental class group and the control class group is not significant with the same variance*" by the formula:

$$t = \frac{\overline{x_{TN}} - \overline{x_{DC}}}{s\sqrt{\frac{1}{n_{TN}} + \frac{1}{n_{DC}}}}$$

Research results

We graded and analyzed the test-taking quality of the experimental students and the control class before and after the experiment, the results are as follows:

Pre-experiment test results

Table 1
Score distribution of experimental class group and control class group before experiment

Score x_i	Students	0	1	2	3	4	5	6	7	8	9	10	$\overline{x}$	S^2
Experimental group	75				2	3	11	20	21	15	2	2	6.55	1.98
Control group	80				1	2	15	18	22	16	4	2	6.65	1.93

Compare the variances of the two groups

We carry out testing the variance of the experimental group and the control group with the hypothesis H_0: The difference between the variance of the experimental group and the control group is not statistically significant.

As $s_{TN}^2 > s_{DC}^2$, we choose the test criterion $F = \frac{s_{TN}^2}{s_{DC}^2} = \frac{1.98}{1.93}$ = 1.0297

The critical values F_α looked up in the F distribution table for the level of significance $\alpha = 0{,}05$ with 75 and 79 degrees of freedom is 1.4599.

We see 1. 4599 > 1.0297 or $F < F_\alpha$

Accepting the hypothesis H_0 means that the difference between the variance of the experimental and control groups is not statistically significant.

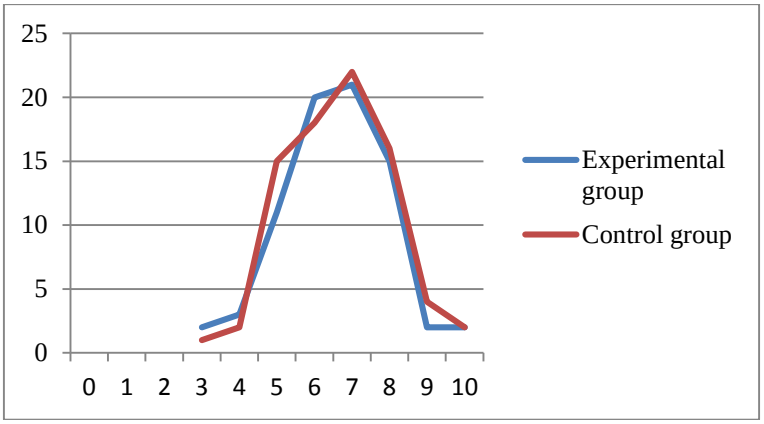

Figure 1. Experimental group and the control group is not statistically significant

After-experiment test results

Table 2
Score distribution of experimental class group and control class group after the experiment

Score xi	Students	0	1	2	3	4	5	6	7	8	9	10	$\overline{x}$	S^2
Experimental group	80				0	2	10	15	18	19	11	5	7.19	2.468
Control group	75				1	5	16	16	15	15	4	3	6.53	2.256

Compare the variances of the two groups

We carry out testing the variance of the experimental group and the control group with the hypothesis H_0: The difference between the variance of the experimental group and the control group is not statistically significant. We choose the test criterion.

$$F = \frac{2,468}{2,256} = 1,093$$

The critical values F_α looked up in the F distribution table for the level of significance $\alpha = 0.05$ with 75 and 79 degrees of freedom is 1.4599. We see 1.4599 > 1.0297 or F < F_α. Accepting the hypothesis H_0 means that the difference between the variance of the experimental and control groups is not statistically significant (Felps et al., 2009; Bellegarda, 2005).

Compare the mean scores of the two groups

Hypothesis H_0: The mean scores of the experimental and control groups are similar.
H_1 comparison: The mean score of the experimental group is higher than the control group (significant level 5%)

$$T = \frac{\left|\overline{x_{TN}}\right| - \left|\overline{x_{DC}}\right|}{\sqrt{\frac{S_{TN}^2}{n_{TN}} + \frac{S_{DC}^2}{n_{DC}}}} = \frac{|7,19 - 6,53|}{\sqrt{\frac{2,4268}{80} + \frac{2,256}{76}}} = 2,64 > t_{0,05} = 1,671$$

T = 2,64 > $t_{0,05} = 1,671$

Hypothesis H_0 is disproved.
So: The mean score of the experimental group is higher than the control group.

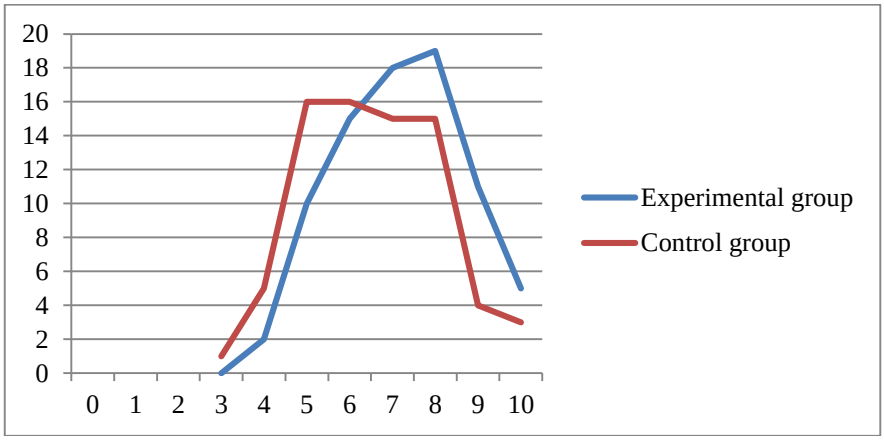

Figure 2. Frequency chart of pre-test scores of experimental and control groups

Through analysis, I confirm that the use of measures to improve Math language had a positive impact on teachers and students at first. However, the desired results have not been obtained. One reason is that teachers may not have a thorough knowledge of the measures, and simultaneously, the way we design the lesson plan, in general, has not clearly explained the intention of the measures to make things easier for teachers and also more effective in the building practices. Some of the content is inappropriate for primary school students, so they continue to struggle with using mathematical language when learning math (Torff & Tirotta, 2010; Manz et al., 2004).

Detection

According to the results of the experiments:

1) The majority of students in the experimental group agreed that the improvement of Math language assisted students in gaining a better understanding of mathematics. Simultaneously, assisting students in becoming more confident and self-sufficient learners. Overcoming psychological barriers such as timidity and apprehension to participate actively in learning activities.
2) As a result of the proposed measures, students are enhanced with activities to practice skills in using mathematical language, including terms, signs, symbols, etc, which have helped students think cogently and express themselves clearly, as well as remember more deeply mathematical knowledge.
3) Improving mathematical language to assist students in learning Math more successfully also assists students in bravely expressing their mathematical ideas, creating a friendly and open atmosphere in learning practice, and thus assisting students in developing communication ability.
4) The experimental results also show that students in the control courses lack flexibility and they are proactive in learning. They as well as timidity, lack confidence, fear of communication, do not know to ask questions and are highly passive in responding to teacher questions.

Conclusion

The findings of this research confirm the efficacy of the author's proposed measures for developing mathematical language competence in Vietnamese primary school students. Especially, the findings of this research show that using the proposed measures, students perform better in mathematical language and improve the math learning outcomes of primary school students.

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