

WHEN MATHEMATICAL PROBLEM SOLVING IS TAUGHT AT SCHOOL: A CASE OF ONE SECONDARY

SCHOOL IN KIBAHA, TANZANIA

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Introduction

Reports from the National Examinations Council of Tanzania (NECTA) show that from 2011 to 2017, the failure rate of students who sat for the Certificate of Secondary Education Examinations (CSEE) in mathematics was above 80 percent. This is a staggering figure. Many reasons leading to failure in Mathematics at secondary level in Tanzania have been investigated. See for example, UNESCO reports. NECTA's reports show candidates' lack of problem solving skills. Problem solving is part and parcel of school mathematics (Schoenfeld, 1985,1992). The poster is about an action research that intended to improve students' engagement in mathematical thinking when solving problems.

The research was conducted at Inspire secondary school, a private school in Kibaha town municipality, Tanzania. Twenty two students took part in the investigation. It started in 2017 when preparing for their (Form II) national examinations. Examples of students' responses from NECTA show a clear demonstration of poor mathematical thinking. Thus, the model similar to Schoenfeld (1992) was introduced to students to help them think during problem solving.

Methods

Students were given problems (from past exams/tests) to solve together with the thinking guide, from the model. They worked individually, in pairs or groups during mathematics club sessions and school preparation times. To gather data, focus groups discussions and document analysis were used. Documents analysed were 40 exercise books, 25 test/examination papers, and more than 100 worked scripts.

The thinking model used involved answering the following questions when solving mathematical problems: what's the problem asking for? What knowledge or skills learned (or experienced) is related to the problem? What method(s) will lead to correct solutions? Does the answer obtained make sense? Has the question been answered? Could there be alternative (and quicker) methods that may lead to the same answer?

Results

Below are two responses (before the action research and during the research) to the problem:
right-angled triangle has sides x cm, (x-1) cm and (x-8) cm. Find the value of x.

Before Action Research

$$(x-1) + x - 8 + x = 180$$

$$3x - 9 = 180$$

$$\frac{3x}{3} = \frac{189}{3}$$

$$x = 63 \text{ cm}$$
 The value of x is 63

During Action Research

Longest side = x
 another side (x-1) and (x-8)
 By Pythagoras theory

$$(x-1)^2 + (x-8)^2 = x^2$$

$$x^2 - 2x + 1 + x^2 - 16x + 64 = x^2$$

$$2x^2 - 18x + 65 = x^2$$

EXAMINATION CENTRE SUBJECTS PERFORMANCE										
CODE	SUBJECT NAME	REG	SAT	NO-CA	W/HD	CLEAN	PASS	GPA	REG/RANK	NAT/RANK
011	CIVICS	22	22	0	0	22	22	2.4091	9/170	67/4919
012	HISTORY	22	22	0	0	22	22	2.5000	8/170	77/4896
013	GEOGRAPHY	22	22	0	0	22	22	2.6364	7/170	68/4916
021	KISWAHILI	22	22	0	0	22	22	2.0000	13/170	127/4919
022	ENGLISH LANGUAGE	22	22	0	0	22	22	1.8636	10/170	81/4919
031	PHYSICS	21	21	0	0	21	21	3.2857	12/165	114/4680
032	CHEMISTRY	22	22	0	0	22	22	2.4091	9/170	51/4883
033	BIOLOGY	22	22	0	0	22	22	1.9545	6/170	57/4916
041	BASIC MATHEMATICS	22	22	0	0	22	22	2.1818	5/170	25/4919

Table 1. 2019 National Examination result: the school ranked 25th in mathematics.

Discussion

Mathematical problem solving, like mathematical problem posing, needs mathematical thinking. It is very different from mathematical computation or calculation. Together with quantitative reasoning, the former includes analytical and logical thinking. For secondary school pupils, analytical and logical thinking need to be taught along with the content. In the research conducted here, scaffolding practice type of modelling is used. Pupils admitted to have improved their mathematical problem solving skills, as the above data shows. Unfortunately, for many schools in Tanzania problem solving skills are not taught due to many reasons including lack of resources and fewer qualified teachers of mathematics. For some schools, especially private schools like Inspire, it is different.

References

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