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High Mathematics Failure Rate: A Socio-Economic Disaster Risk Agent

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Abstract

In this study both qualitative and quantitative research designs were followed in which purposive and random sampling were deployed. 11 respondents from all the 8 schools part-took in the study. A Pressure and Release (PAR) model for Progression of vulnerability was used as a conceptual framework in this study. The key findings showed that overcrowding still remains a problem, followed by lack of resource use in the classroom where some of these are still kept in storerooms. Subject advisors are not visible in the GET band, much attention is given to grade 12. However, these teachers organised extra classes on afternoons and Saturdays as coping mechanisms. The study ended with the following suggestions; motivation of learners, full utilization of resources, equal attention to grade 9 and more focus to be put on lower grades such as grade 8.

Keyword: Vulnerability, Disaster, Hazard.

Introduction and Background

"*Education is an economic issue when countries beyond any doubt out-educate us today will definitely out-compete us tomorrow*" [1]. He further states that through education, nations have better skills, autonomous workers that are able to use their education for creativity, building of wealth as well as putting pressures off government economic programs. Similarly [2] asserts that quality education is a key factor in the economic growth of nations. Moreover, education is a key factor in the sharing of valuable information and knowledge and when used productively, education aids good decision making that ultimately ensures community resilience against adverse impacts of any type of disasters. Disaster risk reduction and vulnerabilities requires knowledgeable people to understand how best to protect themselves, property and their livelihood [3].

South Africa is currently facing a downward trend in the world competitiveness rankings, especially in the factors such as economic growth where she ranked 56th in 144 countries and performed poorly on high education and training and ranked 144th in labour-employer relations [4]. In a report by the World Economic Forum (WEF), South Africa was ranked last in 148 countries in mathematics and science and 146th for overall quality of her education, however these results were slummed by the Department Basic Education (DBE) that they were not credible and accurate as the methodology followed was based on the opinions of business leaders who were not even experts in the field [5]. Contrary to the above mentioned statement, in a 2013 ANA Diagnostic Report whose main aim was to determine learners' performance on knowledge and skills as a result of both learning and teaching, the department of basic education found low levels of competency [6]. In 2012 and 2013 the National average percentage scores in Mathematics

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were 13% and 14% respectively for 9th graders [7]. This paper assesses vulnerability conditions to high mathematics failure rates in one of the Free State Province rural townships which might have adverse effects on nation's economic growth, and further suggests interventional strategies in mitigating these detrimental effects.

Objectives

To assess vulnerability conditions that give rise to mathematics failure in the 9th Grade.

Significance of the study

The results from this study are expected to give an overview of the current situation that might be the cause of failure in grade 9 mathematics thereby leading to an economic growth disruption hence disasters and also to alert authorities, government and other relevant stakeholders to take necessary interventional measures as to mitigate potential adverse effects of disasters.

Research methodology

This study followed both qualitative and quantitative research designs. In a total of 13 schools in Thaba Nchu that offer grade 9, only 8 schools were randomly sampled. From each school, at least one grade 9 Mathematics teacher was selected to represent his/her school. The total respondents were 11 out whom 2 were Head of Departments. The study was limited to only Thaba Nchu intermediate, Secondary and High schools where majority of the learners are from rural areas.

Literature review

A brief literature review was conducted in order to understand the link between mathematics and economy, uses of mathematics in disasters and considerations viewed from Pressure And Release model (PAR: The progression of vulnerability perspective as a conceptual framework of this study).

Hazard is defined as a dangerous phenomenon, human activity, substance or a condition that has a potential to cause loss of life, injury, loss of property, loss of livelihood and services, social and economic disruption and environmental damage [8]. In the context of this study, mathematics failure is regarded as a hazard, a condition that has an ability to retard or disrupt an economic growth of the country. [9] defines vulnerability as characteristics and circumstances of a system, community or assets that make such a system prone to damaging effects of a particular hazard, therefore a combination of hazard and vulnerability give rise to disaster risk given by: Disaster Risk=Hazard × Vulnerability.

Mathematics and economy

The country's general competence in mathematics is regarded as a major component of the economic success and in a study conducted by Organisation for Economic Co-operation (OECD) in the United Kingdom, it was found that the level of mathematics knowledge in the population had a direct link with the Gross Domestic Product (GDP) [10]. Mathematics has not only got a place in economy but also in social sciences as well in political debate as a contribution to conduct of rational debate. It also has impacted positively in forensic sciences through crime detection, which is one of the economic issues that retard the social and economic development [11].

Use of mathematics in disasters

A team of mathematicians developed a computer systems application that is able to estimate the magnitude of natural disasters which is of help to NGO's in decision making [12]. Moreover, an on-site humanitarian aid distribution model was developed by the same mathematician which is based on the use of logistics map of the territory (streets, roads) as well as availability of resources in the nodes to be mobilised to areas of scarcity.

Results and Discussion

The following section presents results and discussion (Figure 1). The above figure shows Home Languages used in Thaba Nchu schools. It is evident that all schools in this area use Setswana as Home Language which is not necessarily a medium of instruction at these schools. Moreover, learners are not forced to speak English in the school campus except in a few schools. English helps learners to express their mathematical thinking and if they are supported to develop their mathematical English, they are likely to participate in Mathematics lessons (Figure 2) [13].

Class size

The average class size from the sampled schools was calculated to be 43 learners per class. The average teacher-to-pupil ration in South African Schools is 1:30. However, this is usually the case in private schools and Government aided schools where parents pay teachers extra in the form of school fees. In poorer schools the ratio ranges between 40-50 pupils per teacher [14]. This shows that there is still a problem of large class sizes in schools.

Pass rate

The average pass rate was also found to be 8.7% for ANA results in September in 2014, lower than the 2012 and 2013 National ANA results (Figure 3).

Technology use

In His speech on the 26th November, 2014 the Honourable MEC Tate Makgoe made a mention that the use of computers

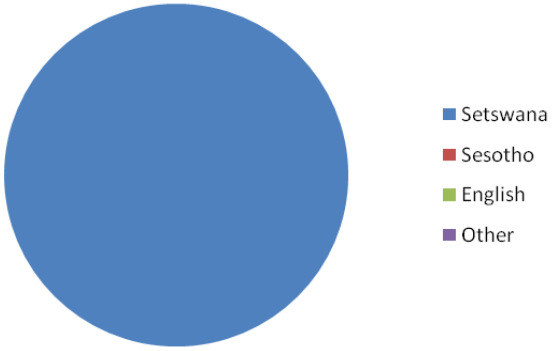

Figure 1: Home Language.

in the teaching and learning is no longer as difficult as it was before. He continued to say that if one has a finger then such an individual is computer literate [15]. They also added that the greatest barrier to lack of technology use is the "mindset" and implementation of technology is disruptive in nature since teachers have to leave their comfort zones to learning how to use technology gadgets [15]. On the contrary, MEC showed that technology does not teach but makes teaching easier and fast. There are many resources in the schools that are not used, some of which are locked up in school storerooms. He promised that he would be going round schools to check optimal use of these resources by 2015. The focus will be in Xhariep and Motheo Districts where there is a need for mathematics improvement, in which case Motheo has the largest enrolment numbers in the Province. Finally "I really want to close the gap between the rural and urban schools technology-wise" said the MEC.

The figure below shows the responses on whether the shown technology resources were available for use in their teaching. Majority answered 'No' meaning there were no resources available. However, the researchers know that many of these schools have been provided with such resources, these responses might be a result of teachers not knowing that these resources are available. It can be deduced that those in control of these resources do not avail them for use by other teachers (Figures 4 and 5).

The Department of Basic Education, from the above figure seems to be working hard in interventional strategies to counter act poor ANA performance, however, subject advisors are visible to give support. This is consistent with the suggestion made in table 2 that equal attention is given to both grades 9 and 12.

The following figure shows a distribution of responses on contextual factors where the most prominent is lack of commitment of learners to doing Mathematics. This followed by parental involvement. However, the current teachers in grade 9 have majored in Mathematics (Figures 6 and 7).

The two tables below show coping and interventional strategies as suggested by respondents (Tables 1 and 2).

Conclusion

In conclusion, one of the key findings of this study is

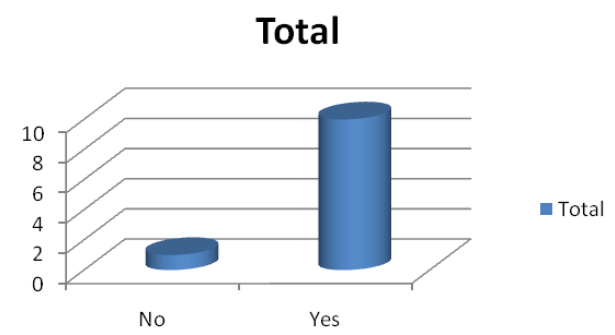

Figure 3: Teachers teaching grade 9 who majored in Mathematics at tertiary. It depicts responses of teachers who agreed and disagreed with the statement that they majored in Mathematics attertiary. Almost all respondents majored in Mathematics.

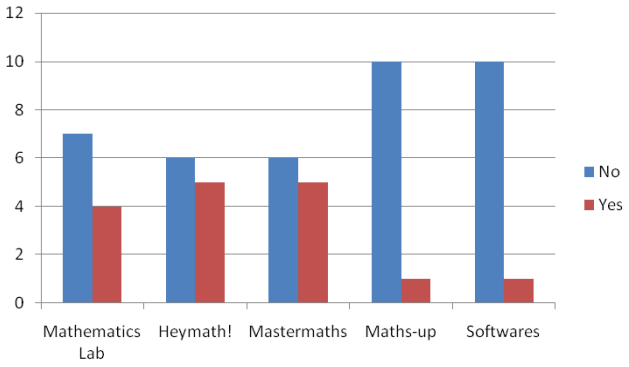

Figure 4: Available technology resources.

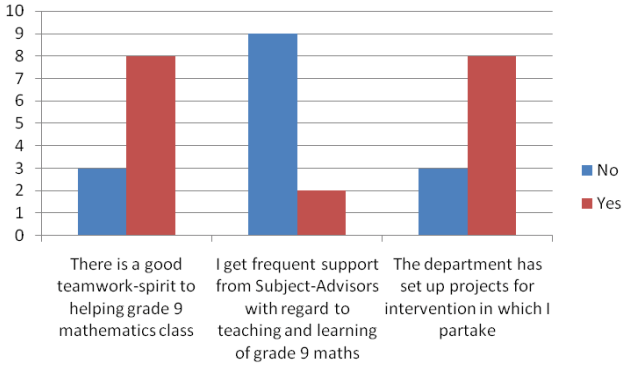

Figure 5: Institutional support.

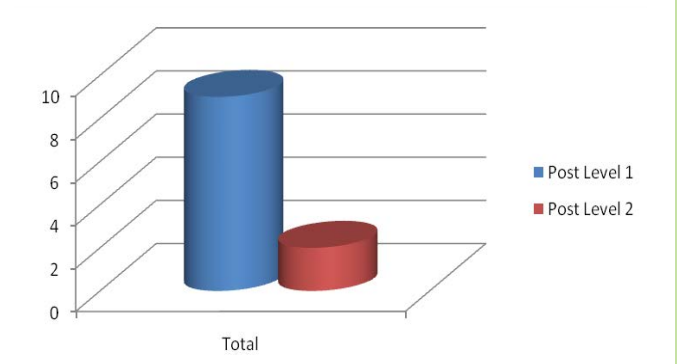

Figure 2: Teachers Ranks. It shows teachers who participated in the survey and their ranks. The majority of these teachers were Post Level 1.

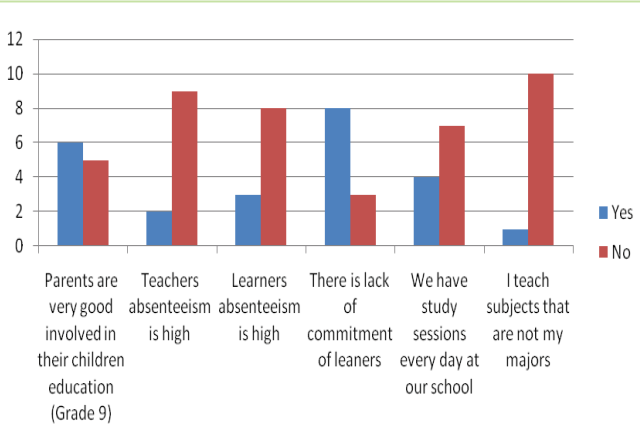

Figure 6: Contextual factors.

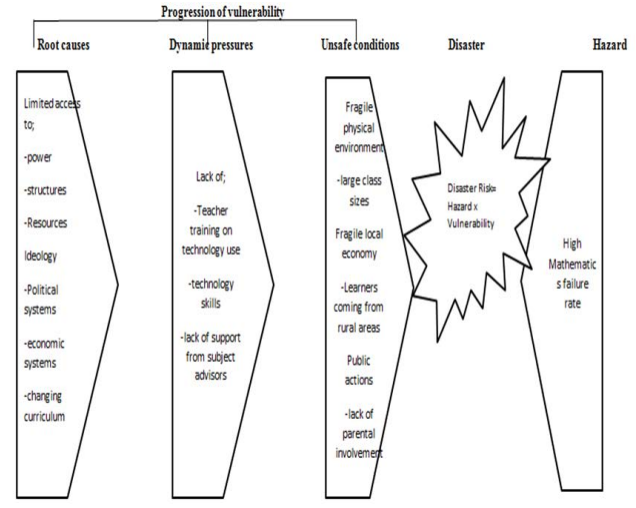

Figure 7: Pressure and Release (PAR) model: Progression of vulnerability.

Table 1: Coping strategies.

Extra classes
Block teaching (*known as Marathon*)
Clustering
camps
Assistance from UFS Mentors

Table 2: Suggested Interventional strategies.

Focus should be directed to lower grades such as grade 8
Grade 9 should be given equal attention as grade 12
Full utilization of resources
Motivational talks

that learners lack motivation, which is highly likely to translate into hatred of the subject. However, literature has shown that most sought-after academic programmes are those in which mathematics plays a critical part. Therefore from the findings, this study recommends that authorities make a follow up of the resources provided to school for optimal usage. Learners to be motivated so that they enrol in Mathematics related programmes post-Matriculation. This will advance economic growth and development in our countries.

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