AN INVESTIGATION INTO SOME MISCONCEPTIONS ABOUT MASS AND VOLUME BY JUNIOR SECONDARY SCHOOL LEARNERS IN ESWATINI

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Abstract

Mass and Volume are important fundamental concepts in Mathematics and they are normally introduced at the Junior Secondary School level across Swaziland. However, simple as the concepts appear to be, it has been observed, as presented in recent annual diagnostic reports, that learners repeatedly make some errors informed by their misconception about these measurements. This paper investigates the causes of the common errors with a view to arresting the trend. 200 students and 15 science teachers were randomly selected from 5 secondary schools in Manzini region as a representation of the other three regions in Swaziland. A combination of cluster sampling and rating scale analysis was employed. Responses collected from questionnaires administered in the course of the work were thoroughly analyzed and interpreted. Some recommendations were also suggested.

INTRODUCTION

Background to the study

There is no gain saying the fact that Mathematics is the backbone of science and Technology. The complexity of modern society has necessitated the need for every man to have a certain amount of competence in basic mathematics for the purpose of daily business transactions, interpreting mathematical graphs and charts, and also to enhance logical thinking and reasoning. Foller and Jessie (year: 44) defined Mathematics as the collective name for geometry, Arithmetic, Trigonometry, Algebra, and certain sciences involving geometrical reasoning. The Advanced Learner's Dictionary of Current English defines it as a science of numbers and size in which Arithmetic, Algebra, Trigonometry, and Geometry are branches. Bell (1979:21,25) argues that no one can grow up without basic numeracy skills, which is the primary raw material of Mathematics or without performing some simple measurements, Also, one of the objectives of mathematics as specified in the early report of Mathematics in commonwealth schools (1969: 162) is that students should enjoy mathematics and not be afraid of thinking about it. This particular objective is very crucial at the junior secondary level. Unfortunately, it is found out that many students all over the country have developed a hatred for the learning of mathematics in our society. In Eswatini for example, majority of the students secure ordinary pass or outright failure in Mathematics in the EGSCE examinations.

This is what prompts an investigation into the probable causes of the high failure rates with some suggestions to arrest the situation or halt the trend. In this work, the focus is on the common errors that are noticeably committed most often by the Junior Secondary School Students particularly on the crucial and basic concepts of Mass and Volume. Manzini South Local Government Area of Manzini Region in Eswatini was chosen for this work.

It is hoped that the outcome of this study will serve as a guide to Junior Secondary School Teachers to identify the ways of impacting knowledge to the students on the concepts of Volume and Mass (of the sizes and shapes of different objective and containers). Also, the findings of this study will enable the Junior Secondary School Student to be able to grasp the concepts. Furthermore, it will help the student to use modern scales in weighing various objects. It is believe that in doing this, student psycho-motor domain is promoted. This will lead also to the development of the manipulative skills and other skills relating to physical co-ordination of the Secondary School Student. More importantly this would serve as an avenue to any researcher for further research work on the same or related topic and with the same focus.

HYPOTHESIS AND METHODOLOGY

The study was based on the following hypothesis.

(1) That the teacher's qualification affects his/her ability to organise suitable atmosphere for effective teaching of the concepts of concept of Volume, Mass and Weight among Junior Secondary Schools.
(2) That Mathematics teachers are overloaded with many classes which results in ineffectiveness,
(3) That the use of concrete teaching aids would create a good classroom atmosphere and go a long way in inculcating the right attitudes into the students and
(4) The children need stimulation and motivation towards the learning of the concepts of volume and mass since they deal with day- to- day life situations.

Methodology

Five schools were carefully selected and labelled schools A, B, C, D and E. The total number of the sample drawn from the five schools was 200 students while the total number of the sampled teachers was 15, comprising of at least a University graduate teacher, a National Certificate of Education holder and a National Diploma holder from each of the five schools. Using a simple random approach, 25% of the sampled students were taught by the University graduate teachers, another 25% of them students were taught by the National Certificate Holders, 25% of the sampled students were taught by the National Diploma holders and the remaining students were randomly distributed and were taught by any of the teachers. Two sets of questionnaires were developed for this work. One set for the subject teachers and the other for the students. Each set had two sections A and B. For the *Students' questionnaire,* SECTION A deals with the collection of demographic information such as the class and age of the student among others while SECTION B were collections of answers raised in the questionnaires and expressed by the following indicators.

Agree — A
Disagree— D
Uncertain— U

SECTION A of the *Teachers' questionnaire* is the same as that of the students while in SECTION B, a teacher is only expected to respond to the question or the statement in the affirmative (Yes or No).

RESULTS AND DISCUSSION

From the preliminary analysis of the data collected with respect to the interest of leraners in Mathematics, the following table developed.

Table 4.1 GENERAL BREAK DOWN

S/N	PARTICUALARS		
1.	Students who like Mathematics	92%	92%
2.	Students affected by Teachers' method	64	42%
3.	Students effected by complex concept	62	41%
4.	Students affected by teaching Aid	64	42%
5.	Students who assimilate well	116	77%

FIG: 4:1

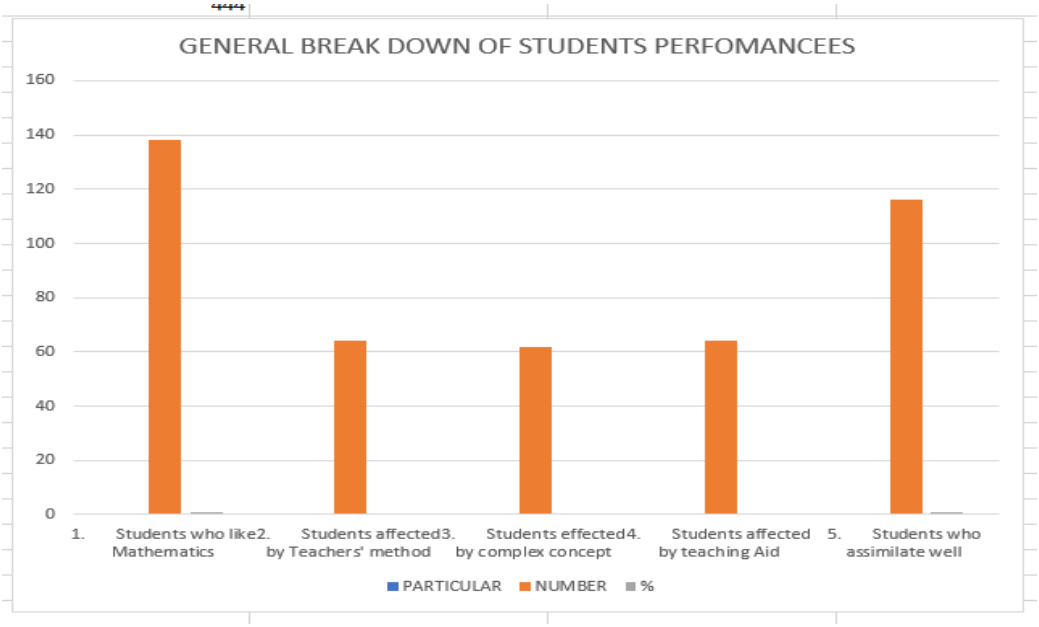

Fig. 1

It is clearly shown here that there is no so much misconception about the general and first-hand view looking at the comparison between the assimilation cognitive domain and the effective domain bar which are 92% and 77% respectively.

TABLE 4.2: TEACHERS YEARS OF EXPERIENCE

TEAGHERS YEARS IN SERVICE	TALLIS	PERCENTAGE
0 - 5	4	4.66.7%
6 – 10	2	13%
11 -15	1	6.7%
16 - 20	2	6.7%
21 - 25	1	6.7%
25 and above	-	-

FIG: 4.2

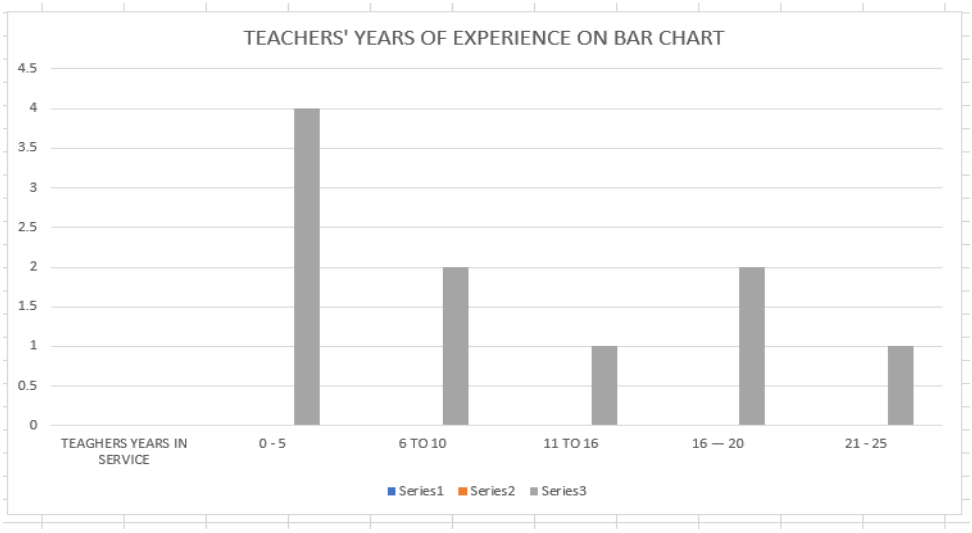

Fig. 2

It can be observed here that the greater number of the teacher teaching these Junior Secondary Students are in their early ages of services which definitely affect the understanding of conception being considered i.e, 667%

TABLE 4.3

NO	PARTICULARS	NO
1	Teachers who like teaching	14
2	Teachers who Regret being a teacher	5
3	Teachers who lack Instructional Materials	7
4	Teaches who had too much workload	5

From this table. it is found out that there is a notable percentage of the effect of Rad instructional materials on the teaching of the concepts. This is 4.6% influence.

FIG. 4.3 GENERAL BREAK DOWN OF TEACHERS IMPACT ON THF CONCEPT ON BAR CHART

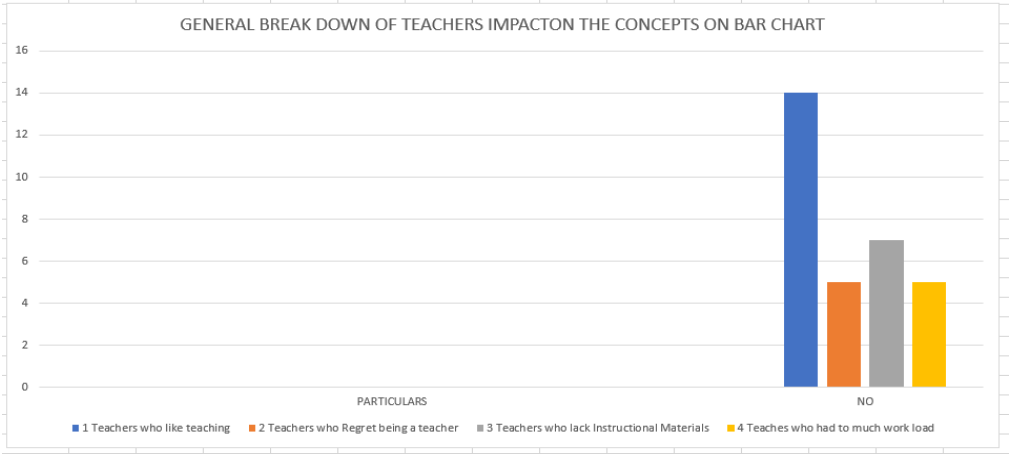

Fig. 3

Fig. 4.3

Teachers have a great impact on the students as regards their misconception about the conservation of the concept. The teachers, however, also are affected by many other variables. Hence this shifts the central tendency which definitely affects the conception of the subject.

TABLE 4.4 COMPARATIVE STUDY OF THE EFFECT OF DIFFERENT CERTIFIED TEACHERS ON STUDENTS ASSIMILATION

	N.C.E.	N.D.	GRADUATE
Students who like Mathematics	8 96%	48 96%	42 34%
Students affected by teaching Method	24 48%	25 50%	15 30%
Students affected by teaching aid	23 46%	22 44%	19 38%
Students affected by complex concept	23 46%	24 48%	15 30%
Students who assimilate well	39 78%	29 58%	48 96%

It is shown here that teaching aid, complex concept and teaching method affect learners' assimilation regardless of the status of the teacher. It ranges from 30% to 50%.

FIG 4.4

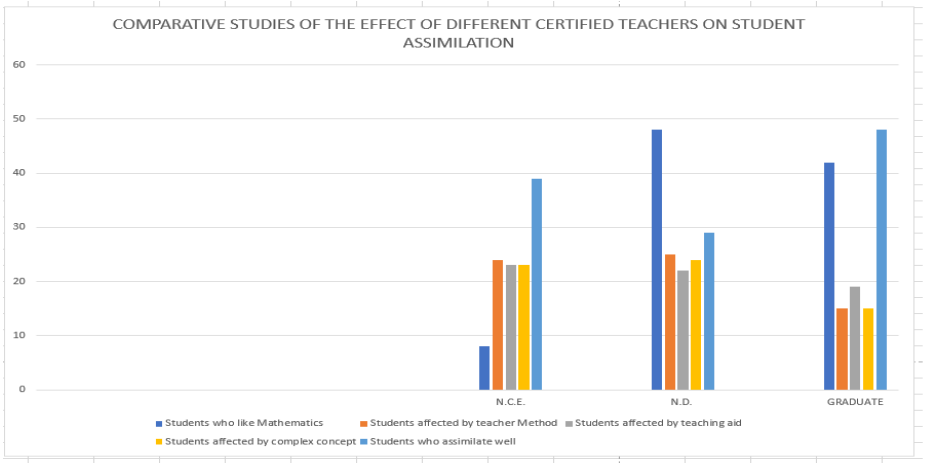

Fig. 4

CONCLUSION

It is evident from the analysis of the responses obtained from students and teachers that there exist some misconceptions about Mass and Volume at the Junior Secondary School students in Manzini region of Swaziland. Some causes identified include lack of instructional materials, teaching methods emanating from content knowledge gaps on the part of the teachers, inappropriate teaching qualification and excessive workload of teachers.

The following recommendations are suggested.

(1) Only certified teachers who are qualified in the field of teaching should be allowed to handle these and other fundamental concepts in Mathematics.
(2) Teachers should be regularly trained and retrained through workshops and seminars so they can improve on their teaching methods.
(3) Good Instructional material should be provided at Secondary Schools to facilitate the dissemination of such concepts in Mathematics.
(4) Workload of teachers must be reduced where possible. Findings have shown that overloaded teachers tend to be ineffective.
(5) Students should be encouraged to develop more interest and good attitude towards Mathematics.
(6) Teacher should give assignments frequently to the student to improve independent problem-solving skills while good appraisal of these assignments would always serve as reinforcement to the students.
(7) Parent should be properly counselled on the importance of Mass and Volume so they can also encourage their children.

Suggestions for further studies and research

This work did not cover curriculum evaluation nor did it examine the teaching methodology in details. The work could therefore be a good platform for further studies and research.

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