

Coaxing unwilling learners into Statistics

Indira Chacko

Africa University, Zimbabwe

Abstract: The paper describes the experience gained by teaching a unit in basic Statistics, to a group made up of teachers on in-service training and student teachers, as a part of a course in Evaluation. Their weak background in Mathematics made them very concerned about doing anything with numbers but the end results indicate that it was worth the effort. This confirms the fact that learning Statistics is more interesting and rewarding when it is related to real data relevant to the learners taught using strategies where the learners are actively involved.

Introduction

This report is based on the approach used, in teaching basic statistical concepts, to students in Education, as part of a course in Evaluation. Primary objective of teaching the unit in statistics was, to enable them apply these in the context of classroom assessment. The paper will cover the views of the class about learning Statistics obtained pre and post teaching, the approach used in teaching and performance of the class on selected items.

Out of the 15 weeks allocated for the course, the unit on statistics was covered in about five weeks. The group involved was made up of 28 teachers on two-year in-service training and six pre-service students in the four-year programme. Both groups were in the final semester of their respective programmes. Each of them was majoring in teaching subjects that fall under languages, social sciences or religious education. Their background in mathematics, as indicated by their performance in School Certificate Examination, conducted at the end of four-year secondary schooling, is given in table 1.

Table 1

Performance in school certificate mathematics

Grades->	A	B	C	D	E	U	DNW	NR	TOT
Male f	-	3	8	3	1	2	-	-	17
%	-	17.6	47.1	17.6	5.9	11.8	-	-	100
Female f	-	3	5	2	-	3	2	2	17
%	-	17.6	29.4	11.8	-	17.6	11.8	11.8	100
Total %	0	17.6	38.2	14.7	2.9	14.7	5.9	5.9	100

Key

A& B- Upper passes

C - Just a pass

D- Fail

F- Lower fail

U- Unclassified

DNW- Did not write

NR- No response

About 18 % had grade B, equally distributed between male and female and 38 % had C, with more males obtaining this. This means that 44 % either failed or did not sit for mathematics. Although Mathematics is optional at school certificate level, job market as well as higher institutions of learning often require a pass in school certificate Mathematics as one of their criteria for selection. This implies that indirectly, Mathematics at school level is compulsory but disliked or feared by most.

Those in the in-service programme were in their mid thirties, which means that they did school certificate examination about 15 years back and since then, they have had nothing to do with mathematics except a handful that were teaching at the primary school level, who are expected to teach all subjects, including Mathematics. The pre-service group, which formed the minority (six), was in their early twenties but they too had problem with Mathematics. On the whole, the class was concerned about anything to do with numbers, which was expressed in a pre- teaching questionnaire. Among the responses to the item on their

concerns about doing a little bit of statistics, two major issues that stood out were that, 'it is number oriented' and 'it is difficult'. All the same, 94% of the class indicated that everyone needs Statistics, which was encouraging to the teacher. In addition, 67% responded positively to the idea of learning basic statistics that would help in student assessment.

Procedure and results:

The approach used in teaching Statistical concepts like the measures of location and dispersion, correlation and the like was based on the theory of motivating learners through utility value of the content using active learning, which was advocated by researchers and educationists alike. For instance Migdady (2000) compared the performance of those taught by integrating statistics and environmental issues to those taught using the traditional text book approach and found the group in the integrated approach performing significantly better than the others. In a longitudinal study, Boaler (1998) compared two groups, one using traditional approach and the other using open-ended, problem-solving approach and found the problem-solving group to be more effective in their learning. Based on the outcomes-based education currently on in South Africa, Steffen and Fletcher (1999) advocate the use of data from the world around the learners, to make learning more meaningful and useful, which is in line with the findings of others mentioned earlier. Swanson & Mc Kibben (1998) through the use of computer based, active learning approach where real world problems were handled, got the students who were non-specialist in statistics change their attitude to the subject. One of the other researchers, Mitchell (1993) using the terms 'catch' and 'hold' of Dewy (1913), found group work, puzzles and computers were good in catching the interest of the learners but failed to hold that interest; where as meaningfulness and involvement were found to catch and hold the interest of the learners.

This classroom research too is based on the notion to capture and sustain the interest of the learners by making learning relevant, useful and rewarding. These students would be using the knowledge they gain in the course, later in the school system where they are expected to handle their students' assessment data, which was one of the objectives of the course which made learning relevant to the class. Or in other words, the learning was outcome-based.

The unit was started by asking the class to reflect on how the students' scores were analysed and interpreted in the school system as well as the defects and merits of the approaches in communicating the information to the students, the parents and the school administration. This was followed by asking the class to bring meaning into a set of percentage scores and letter grades obtained by the class in a couple of courses. At this stage, they were directed towards describing the performance of the class as well as that of the individual relative to the class, the general nature of the test as easy, difficult or just average. During the discussions that took place, the class was able to conclude that there is not much one could do with letter grades but more could be done with percentage scores, which is more commonly used in the school system. From here, the class proceeded to organise the data using Microsoft Excel in various ways like ascending or descending order, grouping and computation and interpretation of various measures of location and dispersion and identification of the measures that are most representative of class performance and rationalizing their decisions. With the help of Excel, they were able to notice the changes in the mean, standard deviation, scatter plot and correlation through the introduction of scores outside the initial range. Explorative learning approach, using data that is their own was novel to these students, through which learning was contextualised hence made very interesting, relevant and rewarding to the learners.

Using a number of computer assignments, students were made to handle classroom test scores and letter grades to arrive at valid interpretations. They were also given a test made up of routine items that involved computation of measures of location, dispersion as well as non conventional items which asked to interpret, take decisions and rationalize those decisions. The responses on selected items are given in table 2.

Table 2
Performance of the class on selected items

Item	Task	Percentage responses		
		Correct	Wrong	Incomplete
Organise data & compute various statistics	Procedural	94	6	-
Decide the best measure of location & rationalise the choice	Evaluative	75	25	
Given mean, s.d. of test scores, decide implications for teaching	Evaluative	41	47	12
Interpret results	Evaluative	94	6	
Given incomplete data, decide the best measure of location	Non procedural	12	88	

Although this group handled real data that they would come across in classroom situation, when it comes to applying the concepts, there seems to be a problem especially when it is related to decision making as well as incomplete data. In the case of incomplete data, majority did not even notice that the data was incomplete and produced an answer. This could be due to the training they have had from childhood that every problem should have a correct solution. It will take longer time to undo the damage done over many years at primary and secondary school levels but the process was initiated in the statistics unit.

At a stage, immediately after they completed a written test in the course, each one was asked to give an estimate of the score they expected in the test, which was used to reveal to them a number of issues like the accuracy of their estimates and the type of correlation coefficients obtained by using all the estimated scores as well as using only the ones that were closer to the obtained scores. As part of the training in evaluation, they were also made aware of the problems linked to under or over estimates of self-performance in terms of the implications for teaching and learning.

At the end of the unit, their oral response to the need to have basic knowledge of statistics was very positive, which was further reconfirmed through the responses to post teaching evaluation, which is presented in table 3.

Table 3
Percentage responses to items in post-teaching evaluation

		SA	A	NS	DA	SDA	TOT
a. Feel much more confident about handling student data	M	5	10				
	%	15.6	31.3				46.9
	f	6.0	11.0				
	%	18.8	34.4				53.1
b. Teachers need not know Statistics	M	5	2			8	
	%	15.6	6.3			25.0	46.9
	F	4	4			9	
	%	12.5	12.5			28.1	53.1
c. Statistics helps in understanding student performance & mine better							
	M	10	5				
	%	31.3	15.6				46.9
	F	13	4				

	%	40.6	12.5				53.1
d. Knowledge of statistics has given me the confidence to use it in the school system							
	M	7	8				
	%	21.9	25.0				46.9
	F	13	4				
	%	40.6	12.5				53.1
e. Statistics does not scare me any more							
	M	6	5	3	1		
	%	18.8	15.6	9.4	3.1		46.9
	F	4	13				
	%	12.5	40.6				53.1
f. Recommend that teachers be given some training in Statistics							
	M	10	5				
	%	31.3	15.6				46.9
	F	11	6				
	%	34.4	18.8				53.1

* Only 32 completed the post teaching evaluation form

Key: SA-Strongly Agree, A-Agree, Ns-Not Sure, DA-Disagree, and SDA-Strongly Disagree

Of all the items, only b which is 'teachers need not know Statistics', has an equally divided opinion of 47% against and 53 % for it. At the same time, they also contradict themselves in the last item by giving unanimous agreement that all teachers be given some training in Statistics. Among the items, b was the only one that was negatively worded which might have led to misinterpretation hence the response obtained, which does not correspond to the responses in other items.

There was another item that asked about the change in attitude to Statistics as a subject and all the responses fell under high negative or low positive to high positive, which was very rewarding to the teacher. Performance on items involving the use of statistical concepts were well attempted and over 80% responded with the correct reasons for selecting particular statistics. Seven of the in-service teachers were very motivated and requested for extra lectures to cover more statistics, which was really encouraging. .

Conclusion

This study was done using a class of 34 adults who had very weak background in Mathematics and they entered the unit with inhibitions. All the same the teaching approach related the concepts to applications relevant to the learners, which is in line with the suggestions of a number of researchers and educationists. The approach made learning interesting and rewarding to the class, which was indicated by the positive response of the class at the end of the unit. In this country, Statistics is one of the areas badly handled at the school level and it is hoped that these teachers would contribute positively towards the teaching of this subject, which is a good beginning.

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