TEACHING BASIC STATISTICS TO STUDENT TEACHERS IN A DEVELOPING COUNTRY: THE STORY OF FRUSTRATION FOR THE TEACHER AND THE LEARNERS

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INTRODUCTION

This paper is based on the experiences of teaching an introductory course in Statistics to student-teachers in their second year of a four year degree programme. The course was covered using five contact hours per week for fourteen weeks. The content was mainly descriptive in nature to provide the foundation for the next levels. In the high school syllabus, eight weeks are kept aside to cover basic statistics like organisation of data, measures of location and dispersion as well as scatter diagrams. New high school syllabus in mathematics covers the same as above which means that these student-teachers need to teach most of the content covered in the introductory course in statistics, in two years time, at the high school level, which makes it doubly important for them to have sound knowledge of all statistical concepts covered in the course as well as the teaching strategies to impart this knowledge that will make learning interesting and challenging to the learner.

PROCEDURE

In order to determine the level of content knowledge of the students, an entry test was administered to the class which confirmed that they had no idea about basic statistical concepts which they were supposed to have covered at the high school level. This made it imperative to start the course from the very basic . In order to make the concepts more relevant to the learners, the course started by gathering data from the class and changing this into information, using various statistical procedures they are to learn, for decision making either in the class or in the campus. By the seventh week, a mid -semester evaluation was done which revealed that majority of the class was not happy about the teaching strategies used and indicated their dissatisfaction and this was more so with the male students, who formed four fifth of the class. This did not come as a surprise, because any one who tried approaches that challenged student thinking was always in the bad books of the students. One to one interaction, in an informal set up, brought out the fact

that they would like to be taught in the way they are used to which is more or less monotonous where concepts are explained, sample questions solved for students to transfer to their lecture notes then problems similar to the ones solved in the class with answers are given for them as home work or assignment which the lecturer is to correct and score . Any departure from this was not welcome. In fact, the results of final examination confirms the idea that learning to these students is more like getting the information from the teacher and reproducing it only for the purpose of passing exams. Any item that tested just a little bit of thinking was poorly answered not that they lack concept knowledge but it was asked in a different way.

Categorisation of items in the essay test with the statistical analysis follow:

Table 1. Categorisation and descriptive statistics of performance in the essay test

	item 1	item 2	item 3	item 4	item 5	item 6	item 7	
	/19(R)	**/7(T)**	**/5(R)**	**/3(T)**	**/5(R/T)**	**/5(R/T)**	**/5(T)**	Total/**49**
Mean	14.0	3.0	4.0	1.0	2.7	0.5	1.8	27.0
s.d	3.77	2.91	1.59	1.03	1.76	0.60	1.13	8.45
Median	13.75	2	5	1	2	0	1.5	27.5
Mode	13.5	0	5	0	5	0	3	29
Min	2.25	0	0	0	0	0	0	7.75
Max	19	7	5	3	5	2	5	42.75
Range	16.75	7	5	3	5	2	5	35

Note: T-Thinking, R- Recall or remembering, R/T- Something in between recall and thinking

Item 1 was on formulation of frequency table and computation of various statistics while item 2 had the scores of 12 candidates in three components of a competitive examination and the students were to use an appropriate statistical method to select the overall best candidate and give the rationale behind their choice. Although they have done score standardisation, in fact a lot on this due to the use of this in assessment procedures used in the schools, the question was indirect which, most probably , affected their performance in this item. Item 7 was also done in class but was framed in a slightly different form. Although the items are tagged thinking, these were only just slightly different from routine recall in the sense that the students needed to determine the statistical procedures to be used.

Items 1 and 3 that test recall have higher means and lower s.d while items 2, 4 and 7 that tested thinking have lower means and higher s.d. Median and mode for all the items on thinking reflect the same trend as observed in the case of means.

The pattern of responses in the short answer form, although slightly better than that in the essay type, corresponds with that in the essay type test items. For short answer items that involved thinking, the mean is 6.4 , with s.d of 2.3, while the total expected is 12.5 and for recall items the mean is 5.4 , with a s.d of 1.41, where the total expected for the items is 9.5. Overall mean for the short answer items is 12 out of a maximum score of 22 with a s.d of 3.1.

The correlation index for the performance in the two types of tests is 0.63(significant at α level 0.01) which is something expected.

The results imply that this group of students possess the concept knowledge and are able to respond to direct questions but are unable to answer those questions that slightly deviated from recall or transfer of knowledge is tested.

Scores for each of the items in the essay test by the class is converted to Z scores for further comparison which is in table 2.

Table 2. Percentage frequency distribution of performance on each of the items based on Z scores

Item	Below -2Z	-2Z up to- -.5Z	-1.5Z up to-1Z	-1z up to the mean	Mean	up to +1Z	Above 1Z to 1.5Z	1.5Z to 2Z	Above 2Z
1(R)	2(5.1)	0	3(7.7)	16(41)	1(2.6)	9(23)	8(20.5)	0	0
2(T)	0	0	16(41)	6(15.4)	0	2(5.1)	15(38.5)	0	0
3(R)	2(5.1)	3(7.7)	2(5.1)	4(10.3)	3(7.7)	25(64)	0	0	0
4(T)	0	0	0	19(48.7)	4(10.3)	11(28.2)	0	5(12.8)	0
5(R/T)	0	0	4(10.3)	16(41)	0	7(17.9)	12(30.8)	0	0
6(R/T)	0	0	0	21(53.85)	1(2.6)	0	15(38.5)	0	2(5.1)
7(T)	0	3(7.7)	3(7.7)	15(30.8)	0	6(15.4)	10(25.6)	1(2.6)	1(2.6)

Note: Figures outside the brackets are frequencies and those inside are percentages, N=39

Items 1 and 3 test only recall which has total percentages of approximately 44 and 64 to the right of the mean where as items 2,4 and 7 are heavy on the left of the mean with percentages of 56 , 49 and 46 respectively.

A χ^2 analysis of percentage distribution of scores is done where the frequencies that are on the mean are merged with those that are one s.d to the right and left of the mean and expected frequencies used are based on the area under the normal curve.

Table 3. Chi- Square for the performance on each of the items

Item	Skill	Chi-square	Level of Significance
1	Recall	29	0.005
2	Thinking	249.9	**
3	Recall	26.4	**
4	Thinking	48.8	**
5	Recall/thinking	65.35	**
6	Recall/thinking	118.9	**
7	Thinking	38.2	**

Note: Expected frequencies are based on percentage areas of the normal curve and df = 6
** Significant at α level 0.005

Although all χ^2 calculated are significant at α level above 0.005, items testing only recall has chi-square values lower than the other five items which indicates that the differences are more in the case of items that tested thinking or a combination of recall and thinking.

DISCUSSION AND CONCLUSION

Although the subjects of this study initially did express a lot of resentment about the teaching strategies used by the lecturer, end of course evaluation revealed a gratifying fact that they gained from the experience. They have had at least twelve years of schooling before joining the tertiary institution and had just three semesters at the tertiary level when the introductory course in statistics was taught. Therefore their ideas about teaching would not have developed at the tertiary level which made it necessary to find out the strategies used at the primary level where the foundation for formal education is laid.

A summary of the data gathered by direct observation of mathematics lessons at the primary school level is in table 4.

The summary table covers the data gathered from 19 teachers in two schools while teaching mathematics. Ratios are given in terms of teacher restricting students or allowing more freedom for student contribution. For instance, where there is more teacher to whole class interaction against teacher to individual interactions, teacher is taking control of the class thereby limiting student chances of asking questions, requesting for information or contributing to the lesson. The other example to this is the student responses which are predicted as opposed to those initiated by the student. When there is more of predicted

Table 4. Summary of classroom interactions

Categories	School 1	School 2
TG:TS	33:10	42:10
GT:ST	37:10	63:10
Dominative: Integrative	47:10	94:1
Recall Question: Thinking Question	47:0	62:0
Predicted response; Initiated response	206: 2	193:1

Note: TG: Teacher to whole class interactions
TS: Teacher to individual student interactions
GT: Class to teacher responses
ST: Student to teacher responses
Dominative: Behaviours like lecture, directives that the students are to follow
Integrative: Probe, relating content to life situation that encourage student contribution, cues
Predicted response: Answer to recall questions
Initiated response: Answer to thinking questions, statements.

responses, again student is answering just to teacher's questions and nothing beyond which means that the student answers only when called for. The summary table of interactions reveals the fact that teaching at the primary school level is by teacher telling and students absorbing the information which they reproduce when asked for. Student initiated interactions is almost nil and the same applies to high level questions. All through the school days, students were not given the opportunity to apply problem-solving approach in learning hence the resistance by the tertiary level students to the sudden change. As Bruce(1995) pointed out, education in the profession is unlikely to be fostered optimally through programmes where the student is a passive recipient of information delivered in lectures and tutorials. He also added that there should be less

reliance on direct instruction and operative direction. There is no better place to start more student- based learning, where decisions about curriculum should be a joint venture of the students and the lecturers, than a teacher training institution because this will flow to the lower levels in the educational system which badly need the change in teaching approach. Instead of tests and examination, independent projects should form a major part of assessment otherwise the tendency to cram the lectures and reproduce at the expense of meaningful learning will continue to dominate the scene.

A lot of research on classroom interactions and classroom climates (Creemers and Tillema, 1988; Chacko,1989) have revealed the need to use more integrative or democratic approach by teachers which encourages learning than domination by the teacher hence the need to train the student-teachers on classroom interactions that are less dominative.

In order to change the teaching of statistics at the primary school level, inservice training for these teachers in content using the approaches they are to use in the class is recommended.

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