

INTRODUCING STATISTICS AT SCHOOL LEVEL IN SOUTH AFRICA THE CRUCIAL ROLE PLAYED BY THE NATIONAL STATISTICS OFFICE IN TRAINING IN-SERVICE TEACHERS

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A new school curriculum, with substantial statistics content at all levels, is currently being phased in throughout South Africa. This paper focuses on a government roll-out plan that aims to upgrade the knowledge of in-service teachers in order to empower them to successfully engage with the statistics content of the new school syllabus.

INTRODUCTION

A new curriculum, with Outcome Based Education (OBE) as a fundamental building block became policy in South Africa in 2002. In recognition of the cross-curricular need for statistics as an anticipated outcome, the new curriculum called for vast amounts of statistical material to be taught at school level. This is presented in the “Data Handling” Learning Outcome of the National Curriculum Statement (NCS), which has been phased in at South African schools over a period of five years with full implementation from January 2008 onwards. Prior to the adoption of the NCS, statistics was generally not taught at the school level in South Africa, with the result that teachers have received little or no training in statistics. This gave rise to a dilemma as in-service teachers are expected to come to grips with the new Data Handling content of the NCS (DOE, 2002, 2003a, 2003b).

It is well documented (Hogg, 1991; Iman, 1994) that statistics generally has a very negative public image, with the result that drastic and urgent action was needed to combat the fear that teachers had of the new statistics content of the NCS. From 1998 onwards, a steady stream of talks and suggested improvements to the imminent new statistics content (North & Ottaviani, 2002) was presented at annual conferences of the South African Statistical Association (SASA), resulting in an awareness of the dilemma amongst statisticians but still not solving the problem!

It was only when the national statistics office (Stats SA) stepped up to assist with the challenge of training teachers that things really took off. The first step was getting teachers to attend the Sixth International Conference on Teaching Statistics (ICOTS 6) in South Africa. Stats SA sponsored a number of teachers and Department of Education (DOE) mathematics subject advisors to this international statistics conference, which was held in Cape Town in July, 2002. The teachers attended a week-long workshop on the statistics content of the first nine grades of the new school syllabus.

When Minister Mankunku, the South African Minister of Finance, opened ICOTS 6, he stressed the importance of learners understanding statistics as well as mathematics. He noted that South Africa needed people who understood the importance of statistics in order to further develop South Africa and argued that the ICOTS 6 initiative would be carried forward. He subsequently launched Stats SA’s Maths4Stats campaign in July 2006, which has the goal of creating an educator corps with a passion and an awareness of statistics. The launching of the Maths4Stats campaign has played off handsomely, as it has resulted in a national network of statistics workshops being planned for teachers, a significant step towards solving the dilemma outlined above.

MATHS4STATS CAMPAIGN

The Maths4Stats campaign, launched by Stats SA, defines a plan, with associated financial support, to address the problem of providing statistics training to roughly 10,000 mathematics educators (grades 10–12), from 28,000 schools in South Africa. It was not intended that Stats SA would “own” the project but rather that Stats SA would initiate the process, ensuring that all stakeholders (especially the DOE) were on board, in order to set the scene to successfully incorporate the statistics content into the core curricula for schools.

In short, the Maths4Stats campaign proposed that a national coordinator would be appointed to oversee and drive the project, while a coordinator would be appointed in each of the nine provinces to manage the initiatives drawn up by the national coordinator. Each provincial coordinator in turn would have a group of trainers to call on who had the expertise to conduct statistics workshops for teachers in their districts. Both the national coordinator and provincial coordinators would be fully employed by Stats SA, whilst the Maths4Stats trainers would conduct workshops on a part-time basis, typically holding workshops over weekends and school holidays, so as not to disrupt the teaching programme.

The first step was to create suitable training material to be used in the Maths4Stats project. Training material for the basic statistics content for the first nine grades of the NCS were put together for the teacher workshop during ICOTS 6 by Delia North and Jackie Scheiber in 2002. They were subsequently appointed as project facilitators (master trainers) of the Maths4Stats campaign, which effectively meant that they were tasked with reviewing and extending their previous material and to provide detailed class notes, exercises and solutions that span the statistics content of the entire school syllabus.

The next step was to start creating a group of trainers for each province. A national statistics competition for teachers was launched, with wide publicity through the national newspapers. Teachers had to apply to be part of the competition, stating reasons why they felt that they would be ideally suited to becoming a Maths4Stats trainer. On the basis of entries received, a group of teachers in each province were invited to take a statistics test that focussed on the interpretation of statistical tables (typically tables produced by Stats SA) and simple every-day probability questions. The statistics test consisted of 20 multiple choice questions. Due to space constraints, only two questions from the paper are presented below:

Question 1. If the Department of Health releases the current percentage of South Africans that are HIV positive, does this number (suppose it was 28%) mean that:

- 28% of males and 28% of females are HIV positive?
- 28% of people in each province are HIV positive?
- Exactly 28% of people in South Africa are HIV positive?
- About 28% of people in South Africa are HIV positive?

Question 2 (refer to table 1 below). Which one of the following statements is NOT correct?

- The percentage of males in Limpopo who are coloured is 0.2
- 6.7% of White citizens living in Mpumalanga are male
- The lowest percentage of Indian/Asian females in any province is in Limpopo
- 74.7% of all males that live in Gauteng are black

Table 1. Census 2001 by gender and population group for three provinces

		Black African	Coloured	Indian/Asian	White	Total
Gauteng	Male	74.7	3.7	2.4	19.2	100
	Female	72.9	4.0	2.5	20.6	100
Limpopo	Male	97.0	0.2	0.2	2.6	100
	Female	97.5	0.2	0.1	2.2	100
Mpumalanga	Male	92.2	0.7	0.4	6.7	100
	Female	92.6	0.7	0.3	6.3	100

All numbers are in percentages (SA Census 2001).

The question paper was set by members of SASA, though StatsSA ran the competition around the country, did the interviews and the final selection of prize winners. Finalists in each province were then interviewed, and a group of 26 teachers in total were selected as prize winners, ensuring a minimum of two teachers selected per province. The selection was based both on marks obtained in the test and racial quota, as there was a commitment to develop a

group of trainers that reflected the racial breakdown of the country. It was the intention all along to develop a group of teachers from around the country to be trained in a friendly atmosphere, so that they should “feel like a family” and not feel isolated and alone. These teachers would then become the core of the group of trainers in each province who would roll-out the statistics workshops as planned by the national and provincial Maths4Stats co-ordinators.

The first part of these teachers’ prize was a trip to Brazil (funded by Stats SA) to attend ICOTS 7, where they had to present a poster depicting any aspect of how they were trying to teach statistics in their schools. The posters were generally on a graphical representation of data that had been collected in a classroom. A typical example is the poster that was presented at ICOTS 7 with title “Graphical representation and interpretation as a result of data gathering”, which had the abstract, “Grade 4 (10 year old) children visited a local supermarket and investigated the breakfast cereals with reference to pricing strategies, stockholding, brand and weights. The data collected was then graphically represented”. The posters were well received, and the teachers had the opportunity to learn from each other and engage with delegates during the ICOTS 7 poster viewing times.

The second part of their prize was their inclusion in the Maths4Stats programme to become trainers. Starting immediately on their return from Brazil in July 2006, all 26 teachers were subjected to various training workshops at venues around the country, again funded by StatsSA. At these workshops the content contained in the Data Handling learning outcome was extensively covered, with specific emphasis on introducing material via a problem centred approach. A typical example is the following extract from the training material:

Do you think a 6 has the same chance of coming up, when a die is tossed, as a 1 has?
The learner is then tasked with tossing a die 30 times in order to complete a recording sheet (Table 2).

Table 2. Recording sheet for the “6 vs 1” die rolling problem.

Outcome	Tally	Frequency	Relative Frequency
1			
2			
3			
4			
5			
6			

The following questions are then posed: (1) What do you notice about the relative frequency of a 1 coming up when a die is rolled 30 times compared to that of a 6 coming up?; (2) Did the other people in your group get the same result as you did?; (3) What happens if you combine the results of the whole class?; (4) Was your initial thought correct? Explain.

Following a sequence of workshops presented by the two project facilitators over a period of 12 months, the prize winning teachers were invited to take a test in June 2007, in order to assess how much they had learned since winning a place on the Maths4Stats training team. The results were very satisfying, with the majority of teachers getting over 75%, as can be seen from Figure 1.

By July 2007 the 26 teachers on the project thus had the basic statistical competency required to engage with the data handling content of the NCS, so the emphasis shifted from simply training them in content to building them up to have the confidence to train other teachers. The teachers were thus invited to present something on data handling or on probability at the annual national conference of the Association for Mathematics Education of South Africa (AMESA). This had the further spin-off that it would create awareness of statistics among the other teachers who were not on the Maths4Stats project. One of the strands at the conference was entitled “How it works in my classroom” and consisted of 30 minute (20 minutes for presentation and 10 minutes for questions) slots. It was felt that presenting something like this would be a good place for the Maths4Stats teachers to start speaking to other teachers. Fourteen

of the group rose to the occasion and submitted first drafts to the two facilitators, who edited them and made further suggestions to improve the presentations. Some handled this with ease, while others needed extensive support and endless exchange of e-mails and faxes before the final product was ready to submit. All submissions were accepted by the conference organisers, so the next step was to assist the teachers with their presentations, help them prepare *PowerPoint* slides and guide them with presentation skills. The teachers were supported during the presentations by the two facilitators (just in case questions were asked that the teachers couldn't answer), but, in fact, neither facilitator was needed as the teachers were able to do their presentations and to answer questions with ease. At the end of this, the teachers realised how much they had learned in the year and how much farther ahead in their knowledge they were than the majority of the other teachers at the conference. It was amazing to witness how they supported each other during the AMESA conference, indicating that the objective to make them feel like a "family" certainly was working!

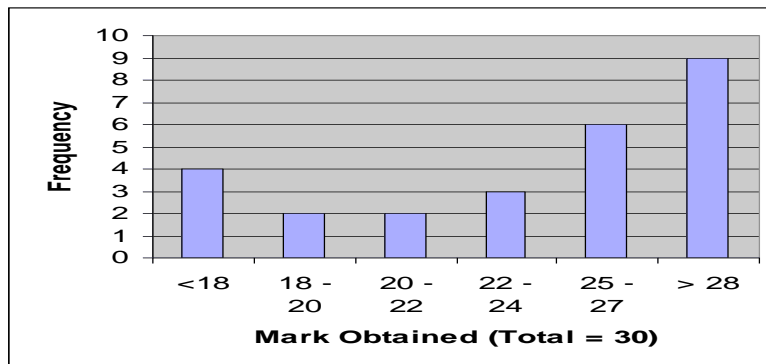


Figure 1. Assessment of NCS Probability knowledge (Maths4Stats teachers, July 2007)

A lot of thought has gone into ensuring that the Maths4Stats trainers have the necessary content knowledge, confidence and presentation skills, to successfully feed into the roll-out plan as defined in the Maths4Stats project. The teachers could not become "fully endorsed Maths4Stats trainers" until they had obtained at least 75% on a test based on the entire statistics content of the NCS and also successfully passed an oral presentation, as judged by the project facilitators (entry to the oral only possible once the written test had been passed at the required level). Once fully endorsed Maths4Stats trainers, they would then be eligible to run further workshops in their districts for teachers (for which they would be remunerated), using the material prepared by the two project facilitators.

The DOE has come on board with this initiative and have recently joined forces with the Maths4Stats campaign. In April 2008, a group of 172 DOE subject advisors from all nine provinces in South Africa will be trained by the project facilitators. They form a link between the Stats SA initiative and DOE, crucially necessary to ensure that the roll-out plan of the Maths4Stats campaign will be taken seriously by mathematics teachers.

The next step is that a "steering committee" will be formed for each province, which will consist of the Maths4Stats trainers and the DOE subject advisors for that province and will be chaired by the provincial coordinator. In addition, SASA has identified an academic statistician for each province, who will give further mentorship and guidance, if and when necessary, to the provincial steering committee.

The DOE have mandated that the statistics workshops to be given in each province will form part of the list of compulsory workshops that the teachers have to attend, thus providing the last piece of the puzzle to ensuring the success of the Maths4Stats roll-out plan.

FURTHER OBSTACLES TO TRAINING TEACHERS IN SOUTH AFRICA

South Africa is a very complex society with social, economic and cultural diversity. With about 15% of South Africans being illiterate, many children are first generation readers and thus cannot hope to get guidance beyond the classroom. A further problem is the level of

preparation with which learners enter the schooling program, as this can differ greatly from rural to urban schools. Teachers have to cope with the new content while addressing all the issues that go along with large classes of students learning statistics in a language that could be their second or even third language (DeWet, 2002).

Language is a major issue to consider in South Africa, as there are 11 official languages, and statistics training is primarily to be done in English. The following figure shows the home language of a group of teachers attending a statistics workshop during a SASA conference.

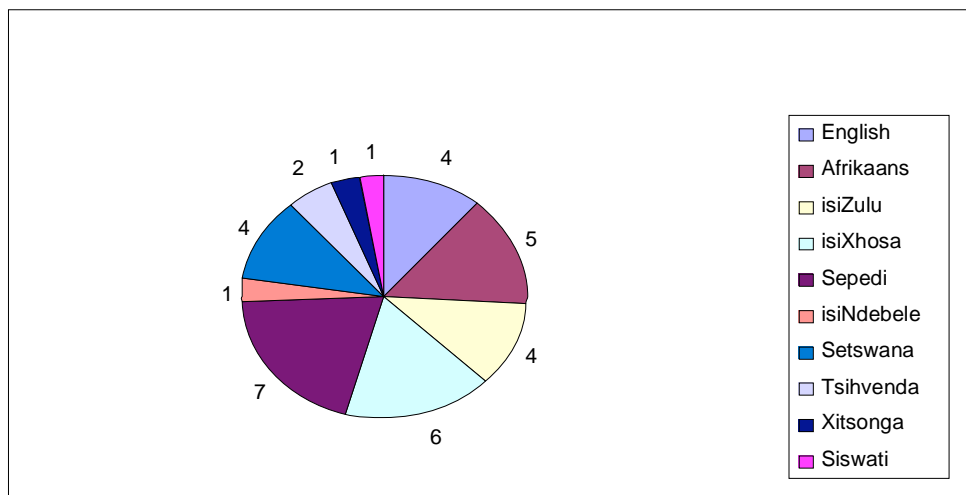


Figure 2. Home language of workshop participants

A further problem to note is that the NCS requires teachers to totally change the way in which they teach, in every aspect of their task where, for example, groupwork and continuous assessment play a far bigger role than in the previous education system. Teachers are facilitators and encourage class discussions as opposed to the class quietly listening to the teacher in the previous system. This is all very different from what had been the case previously, and there was thus an urgent need for in-service training for teachers to assist them in achieving the goals of the new curriculum (Taylor, 2000).

Training for the NCS is done by DOE Subject Advisors, themselves products of the previous curriculum and thus also not having the required statistics content knowledge. As a result they focus on things with which they feel comfortable, such as policy and assessment issues. Attendance at these training sessions is compulsory, but the teachers leave them feeling very dissatisfied as they need content knowledge that is not forthcoming.

The National Department of Education is aware of this situation and in order to not have a large group of scholars failing the external examination at the end of 2008 have designated certain topics in the Further Education and Training (FET) mathematics examination as optional topics, among them probability, with an optional paper on these topics being offered at the end of the next three years. Teachers were told that they were being given these three years to take responsibility for gaining the required content knowledge, with the idea that the optional topics will become compulsory at the end of 2011. To date there have been no national training programs on Statistics content run by the Department of Education.

A further confounding problem is that the new FET curriculum states that all learners have to do either Mathematics or Mathematical Literacy (a syllabus which aims to ensure that learners have the basic Mathematics skills that are needed to function in society (DOE, 2003b)). Prior to 2008, school leavers could avoid doing any form of mathematics in their last three years of schooling, with the result that the NCS requires even more teachers to have a basic knowledge of statistics as Data Handling is one of both the Mathematics and Mathematical Literacy Outcomes; this poses a huge problem as there is already a severe shortage of

mathematics teachers in South African schools, and the problem is now being escalated tremendously with so many more mathematics teachers needed!

The problem of upgrading in-service teachers' skills so that they could successfully engage with the Data Handling content of NCS is thus complex and careful planning needs to be done by the provincial steering committees.

CONCLUSION

The new school curriculum introduced statistics into the school syllabus for the first time ever in South Africa. This content has to be taught by teachers who have had little or no training in statistics. Statistics South Africa, the National Statistics office, has selected a group of teachers who are being trained, so that they can become statistics trainers of other teachers. A major part of the planning has been to give the teachers rewards such as sponsoring their attendance at national and international statistics conferences, in order to motivate them and to assist them to gel as a group, giving support and motivation to each other. This project has already paid off as the selected teachers have demonstrated content knowledge, and many have given a talk at a national conference and are keen to start giving workshops in their areas. The Maths4Stats campaign has managed to excite teachers about the new Data Handling content of the NCS, despite the many problem areas outlined above. If the enthusiasm and enjoyment of statistics shown by the Maths4Stats teachers are anything to go by, then there is great hope that South Africa will indeed be moving towards producing statistically literate school leavers in the near future!

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