INITIAL AND IN-SERVICE TRAINING OF TEACHERS OF STATISTICS: IN-SERVICE TRAINING TO ASSIST JUNIOR HIGH SCHOOL TEACHERS TO IMPLEMENT A NEW SYLLABUS IN STATISTICS

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1. Introduction

The introduction of statistics into local mathematics syllabuses in 1984 has stimulated much activity in the field of teacher education, in both pre- and in-service courses. It is widely accepted in many countries throughout the world that "whatever the system of education in existence, teachers must be given continuing opportunities for learning" and that "a single course of teacher training, however long it lasts and however excellent it may be, no longer suffices" (UNESCO, 1970, p.24).

Bearing in mind, also, that "the teaching of statistics is substantially more difficult than many other branches of mathematics" (Barnett et al, 1979, p.3), that most of our teachers have an inadequate background in statistics and that few of them have taken a methods course covering the teaching of the subject, it was clear that there was a need for some form of in-service education and training to help teachers at the junior high school level to implement the new syllabus. Thus a short in-service course was designed to meet the needs of these teachers.

2. Some considerations in designing the course

Much has been written about in-service education and training, with some authors making a clear distinction between the education and training aspects (e.g. Ashton et al, 1983; Morant, 1981). It is sufficient at this point to note that many educationists regard in-service courses as being aimed at the improvement of teachers' professional knowledge and job performance skills. There is also a growing body of research-based knowledge about factors related to the effectiveness of in-service courses. For instance, courses taught solely through the medium of lectures have generally failed to have any significant impact on practice, partly because they were too far removed from classroom reality and partly because the needs of the teachers had not been identified (Ashton et al, 1983), while short courses which attempt to cover too much material, often lead to course presenters relying heavily on the lecture method (Rudduck, 1981). In an interesting and insightful meta-analysis of research in the area of in-service teacher education, Wade (1984) reached a number of conclusions which serve as useful criteria for the design of in-service, courses: (i) courses that originate outside the school are generally more effective than those which originate in the school; (ii) active participation in a course is more effective than receptive participation; (iii) practical instruction is preferable to theoretical instruction; and (iv) the focus of a course should be on the concrete with teacher-specific plans, rather than on abstract, talk-oriented sessions.

Equally valuable for the in-service course designer is the work of Meyer (1974; 1975; 1978). In a review of types and patterns of in-service courses, Meyer (1976) identified five basic dimensions which are vital in determining the characteristics of a course.

(i) Time, i.e. the duration of the course, the frequency of the meetings, whether the course is full- or part-time, in school time or out of school time.

(ii) People, i.e. for whom is the course intended, e.g. junior high school, senior high school.

(iii) Form, i.e. lectures, discussions, workshops, demonstrations, or combinations of these.

(iv) Objectives, i.e. knowledge or skills to be learned and developed, e.g. knowledge of subject matter, general educational issues, classroom skills, management skills.

(v) Sponsor, i.e. education authorities, universities, teacher education institutions.

Taking the above ideas into consideration, our local course took shape in the following way:.

(i) Time: the course was designed for two sessions of two hours each, to be held after school in the late afternoon. Teachers welcome this kind of short duration programme because it does not encroach on school time or interfere with personal and family life (Meyer, 1975).

(ii) People: as changes had occurred in the junior high school mathematics syllabuses, the course was intended for teachers at that level.

(iii) Form: the course was to be presented by means of an informal, experiential, activity, based approach. This would ensure that teachers would "go through a learning process at their own level similar in content and style to the learning process they might subsequently use with their own pupils in school" (Rudduck, 1981, p.34).

(iv) Objectives: these were (1) to upgrade the teachers' knowledge of the subject matter and (2) to develop skills needed for teaching statistics in the junior high school.

(v) Sponsor: the local branch of the Mathematical Association of South Africa (MASA), in conjunction with the local Teachers' Centre.

3. The implementation and development of the course

The course was conducted first at the local Teachers' Centre, has been presented as a statistics workshop at two annual meetings of MASA and also formed half of a MASA sponsored weekend camp on statistics and calculators. Numbers of teachers attending have ranged from 30 to 80. While

the basic structure of the course has not been altered to any great extent over the last three years, there have been adjustments to the actual content of the course as a result of comments from the participating teachers and experience gained in presenting it. The methodology used has been typically as follows:

Session 1: After a short introduction to the course and the handing out of printed notes, teachers participated in a group activity, called the "Ice-breaker", that was intended to help participants to relax and get to know one another, but which also served to highlight the difference between discrete and continuous data (Juraschek & Angle, 1981). For the next activity, the question "What kind of class are we' was posed. Working in groups of four to six, the teachers were then required to carry out the following tasks: (i) collect data from the members of the class; (ii) tabulate the data in a suitable way; (iii) display the data using an appropriate graph; (iv) calculate the mean, median and mode where appropriate; and (iv) produce a "white paper', i.e. write a few sentences about the graph, ask some questions about the data that were collected and the results obtained. During the following report-back session, each group was called upon to display its graph and accompanying results. This usually involved a great deal of valuable discussion and comment.

Session 2a: The form for this session was one of active participation on the part of the teachers. The focus was on practical experiences that will lead to an understanding of ideas of elementary probability. Teachers worked in groups and carried out experiments that involved tossing coins, rolling dice, choosing cards etc. Supporting materials also included a micro-computer with a number of demonstration programs.

Session 2b: This was an alternative to Session 2a and yielded fruitful results. Teachers formed small working groups and produced a working document that provided guidelines and ideas for the teaching of statistics by project work.

4. Projects in the teaching of statistics in the junior high school

(i) Usefulness and importance of project work

Many reasons were advanced for the value of project work. These included: enabling children to see the practical uses of statistics in daily life; providing an opportunity for children to learn by doing, to work by themselves and in groups; helping children to develop a critical awareness of statistical reporting; integrating mathematics with other subjects in the curriculum.

(ii) Practical guidelines for implementing project work

- Introduce the topic of statistics informally in class by asking questions relevant to the interests of the children. These may also serve to highlight individual differences.

- Choose one particular suggestion from the class. Let children decide how they will interpret and represent the data.

- Take the most recent class marks and consider how they can be tabulated and graphed in different ways. Discuss how these graphs may be used to analyse and interpret the data and how conclusions may be drawn.

- Set worksheets that emphasise the sequence: collecting, tabulating, graphing data; calculating mean, median, mode; interpreting graphs and drawing conclusions.

- When subject matter has been taught, let children choose their own topics and conduct their own surveys. The data should be presented in a similar form to that discussed in class. Project should be completed within about three weeks.

- Let children present their projects to the class so that critical discussion of results can be encouraged.

(iii) Ideas for projects

The most important concern is that the children should regard the topic for a project as being relevant, interesting and of personal concern.

- Test marks from a previous test.

- Distance travelled to school each day.

- Time spent watching TV, doing homework, playing sport. Some comparisons may be possible.

5. Conclusion

Statistics abound in the world around us and feature in part of every aspect of our daily lives. Open a newspaper and we are confronted with facts and figures about something: unemployment figures, road accident figures, divorce rates, foreign exchange rates, business conditions. These facts are frequently accompanied by some form of chart diagram or graph. It is particularly important that by the time our children leave school they should have some idea of how such information is collected, what the various types of graph mean and how reliable the information is likely to be (Walker & McLean, 1973). If we are to be successful in such an endeavour, we need teachers who can encourage children to think about such ideas. Good statistical teaching can encourage this and it is hoped that the in-service course described above goes someway towards helping teachers to show that statistics is essentially a useful subject.

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