THE USE OF STATISTICAL PROJECT COMPETITIONS TO ENHANCE STATISTICAL UNDERSTANDING

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The use of project work has been successfully implemented into many statistical education programmes. Three countries, of interest to this paper, that have implemented Statistical Project Competitions are Hong Kong, Pakistan and the United Kingdom. The competitions, in these three countries, are run in different formats but the educational outcomes are similar. The aim of this paper is threefold namely (1) to compare and contrast project work in Hong Kong, Pakistan and the United Kingdom, (2) to outline the skills and techniques required for a clear understanding of how project work can be incorporated into the statistical curriculum and (3) to review and assess the importance of project work for statistical education programmes within educational establishments.

INTRODUCTION

Statistics is essentially a practical subject and one of the main advantages of using projects is that, for many students it is the first time they are exposed to real data. The students then have to decide what data to collect, how to attain this data and what to do with the data. Projects put statistics into context and allow students to connect various pieces of knowledge together in a practical way. National competitions have been set up in Hong Kong, Pakistan and the United Kingdom, funded by various sources. For each country, a prize is awarded as a reward for the best piece of work submitted for the competition. The competitions allow students from across each country to compete with each other for a national prize. The prize provides an incentive for the students to participate. There are many similarities between how the three countries run the competitions, and the main educational aims are that the students see and use statistics in a practical environment.

Any project involves a student, or group of students, working under the guidance and direction of the teacher. A project involves planning and developing a schedule of study with outcomes to be achieved over a period of time. Implicit in the project is the deeper understanding of the subject and the bringing together of many statistical techniques. The students are not required to only produce a single outcome, but are required to link multiple, often distantly related, prior learning tasks. The experience gained by the students and the teachers, involved with the projects, has been of enormous benefit to the statistical education in these countries.

HONG KONG

The first Statistical Project Competition in Hong Kong for secondary schools was introduced in 1986. This was a major step forward in getting students to participate in using statistics in a practical way. Hong Kong's curriculum is oriented towards examination success and hence topics of interest, that do not have a direct bearing on examinations, are not always readily received in the classroom environment. Educationally one could argue that carrying out some practical statistics would hopefully enhance the students learning and understanding of the subject matter. Shen (1996), when writing about the secondary education in Hong Kong, stated that "Statistical Projects with emphasis on data analysis are even rarer. It was seldom, if not never, seen until the Hong Kong Statistical Society launched the first Statistical Project Competition." (p. 31.)

To enter the competition, a group of students have to carefully consider and plan an area of statistical interest that they wish to peruse. The students then collect any relevant compiled data that is required, perform relevant statistical analysis that is needed to answer the area of interest chosen, provide justification for any hypothesis or arguments stated, and draw a sound and well justified conclusion. The findings are then compiled into a written report that not only includes the conclusions reached but any statistical diagrams, hypotheses tested, description of why and what data were collected and any relevant information the group thinks is appropriate to enclose in the report. The regulations of the competition do not allow students to collect raw data.

Shen (1996) interviewed teachers and students who had participated in the competitions in Hong Kong. Her findings were that for many students it was the first time that they started to understand or grasp the significance of what they had learned in the statistics classes. The students had to make decisions on what analysis to perform which is very different from being told in an examination to perform a hypothesis test to see if there is any difference in, for example, the test results for class A and class B. The students have to decide if this is valid or required for their chosen area if interest. This decision making process helps the students to identify when to use a particular technique and what the results mean. Statistics is part of the mathematics curriculum and whereas, in mathematics where there are formal techniques to use, statistics mirrors real life problems where there is often no right answer. The students have to fully justify the arguments they put forward and use statistics to support their claim.

The competition, in this country, provides the students with the opportunity to use statistics in a practical environment. Shen (1996) goes further to recommend that the use

of project work be formally included in the examination and assessment system in Hong Kong.

PAKISTAN

Habibullah (1992) stated that "It is imperative that practical projects involving the collection and analysis of real data be made an integral part of the Statistics courses at the FA/FSc level and BA/BSc levels." (p. 16). The government of Pakistan introduced small scale projects into the examination assessment for the first time during the academic year of 1992-93. At Kinnaird College, Lahore, Pakistan, a considerable amount of progress has been made over the last decade to try and bring into statistics a practical element. This has partly been achieved by the Inter Collegiate Statistical Competition (ICSC) which was held for the first time in 1990 for all colleges/schools in Pakistan and held annually ever since. In 1997, for the Golden Jubilee Year of Pakistan, the Department of Statistics at Kinnaird College for Women, Lahore, launched the Data Analysis Talent Award ('DATA') for the world-wide community of students aged 16-20. This extremely ambitious competition, which was not successful during 1997 but is re-launched for 1998, is aimed at students from any country to submit a project following the same rules as for the ICSC. The rules of the competition can be summarized as follows:

1. Students may participate in this competition either individually or in the form of teams of 2 to 6 students under the supervision or guidance of a teacher.
2. Each student/team should carry out a statistical project as follows:
   a) Choose the topic of their study.
   b) Decide the specific objectives of their study.
   c) Decide the source of their data (i.e. the geographical area/institution(s) /socio-economic category of the people from whom the data are going to be collected).

   The study should be based on real, freshly collected/primary/unpublished data.
   d) Devise a methodology for data-collection.
   e) Analyse the collected data and draw conclusions.
   f) The study should be presented on a set of 2-4 posters.
   g) A report of the project in the form of a 5 to 10 minutes video recording or audio recording or in the form of a written paper/article. (In previous years only the posters were required).

Problems raised by teachers in Pakistan are that students have problems defining and applying simple concepts. The text books used are not suitable for practical statistics of the type needed to help students with project work. Examples of positive outcomes were that the competition is both educational and interesting, it brings practical confidence in participants, and the exhibition of the competition entries is a good way to show new students who wish to participate in the next competition.

UNITED KINGDOM

Statistical competitions have been around in the United Kingdom for the past two decades. The Royal Statistical Society provides sponsorship for projects from school level up to graduate level. The topic is invariably chosen by the student or group of students. Data can be collected from published sources or the student(s) themselves. The analysis of the data is decided by the student(s) with guidance given by their teacher(s). A formal report including description of the project, methods used, tabular and graphical presentations and conclusions reached is produced for the competition entry. It is unusual to have a video or audio recording of the student(s) work. A committee of statistical experts and statistical educationalists then decide on the winner(s) of the competition. The project competitions are divided into categories usually by various age ranges and prizes awarded to each category.

Teachers have become familiar with this type of work over the years; however, the number of entries to the competitions have decreased over the years. One reason for this is that the emphasis on National Testing and Assessment has taken priority over these competitions. Statistical projects are part of the examination assessment in the United Kingdom. The emphasis on practical work has posed teachers with many problems. Finding suitable problems for practical work to be carried out and how to incorporate these practicals into the classroom environment is the most frequent worry.

SKILLS AND TECHNIQUES

“Project work is a method of allowing students to make to use what they have learned in statistics classes in a practical context. It is this practical application of projects that make them such a useful part of the learning process.” Starkings (1997, p.139).

Holmes makes the distinction between practicals and projects as “A practical introduces the or reinforces some particular theory; a project links a number of topics. ...A

project also requires a more substantial report to be written, while practicals are more easy to control than projects but do not develop global skills" (1997, p. 157).

The incorporation of project work into statistics lessons has demonstrated to both teachers and students alike that this is a demanding technique. Students need to link topics and techniques they have learned which is much more demanding than learning one fact after another. Students have to be able to transfer skills from statistics to say projects in other areas such as geography and science. Familiarisation of a great deal of information plays a vital role in these projects. Decisions have to be made as to what techniques are applicable to use. Careful planning, by teachers, of lessons and syllabus areas to be covered have to take place before commencing the projects. Teaching often continues during the project life time, and the teacher should set aside time for the students to complete their projects. The teachers' role is one of facilitator of learning as opposed to instructor. The teacher guides the student through the project giving help and assistance when required. In this context the teacher has to be familiar with a variety of statistical techniques, and new teachers may find this a difficult concept to deal with. The teachers' role is multi-tasked. They have to check that the students are engaged in meaningful activities, motivate students as and when required, carefully plan the lessons allowing time for students to do the project work and grade/mark the students work according to the assessment criteria.

For a project to be successfully integrated into the curriculum the following should be taken into account: "It is important that both teachers and students know precisely what is involved in doing project work." Starkings (1997, p. 140).

CONCLUSIONS

The importance of project work in the curriculum is manifold; however, the use of projects for competitions is no panacea for solving all problems. The competition can be a motivating factor to aid the learning process, but care must be taken so that the project does not become the only important topic the student is working on. Students need to beware that other subject lessons may still be taking place and award due time to these lessons as well as the project. For a project to be successful, teachers should ascertain that students are able to solve novel problems, devise an approach to investigate the problem using appropriate techniques, keep details of the progress of the students, communicate results to students as and when required and be readily able to discuss the

results with the respective students. If students are carefully guided during the projects' duration, then the integration of the statistical techniques can be readily assimilated and used when required.

Education is the main concern of the teachers, and one of the main aims is the student to become an autonomous learner. Project work provides a medium whereby the student can be helped to develop this autonomy. The use of project work to promote self-directed learning is a worthwhile activity in itself.

The three countries described in this paper have successfully integrated the project competition into their respective curriculum. There are similarities between all three countries competitions such as a prize is awarded, the project is presented in a similar format and the educational outcomes are identical, i.e., that the student(s) use statistics in a practical environment to enhance their learning and understanding of statistics.

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