FINAL YEAR BUSINESS STUDENTS EXPERIENCES OF DATA ANALYSIS IN PROJECTS ®

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Project work has been implemented in the assessment of the final year students in a University Business School. The main objective of the project is to develop students' research skills. Although the project is not necessarily a statistical project, many of these projects involve data analysis. Hence, statistics has become a substantial part of the exercise. However, students have limited understanding in statistics and research methods, thus the main concern is whether they equip themselves in data analysis and what difficulties they encounter while handling data. The paper gives an overview of experience in data analysis for these students. The study is based on a survey conducted amongst the final year students upon completion of their projects. Students' views of data analysis were assessed. Conclusions were drawn in terms of the results, and positive and negative experiences of the students. The strengths and weaknesses of the data analysis are identified. Ways to improve the statistics curriculum and assist students to master the statistical skills in data analysis in future are discussed.

INTRODUCTION

Project work has been implemented in the assessment of the final year students in the Business School of Nanyang Technological University (NTU) in Singapore. An objective of the project that is highly regarded in the School is to develop students' research skills. Students can choose a project on any topic on various aspects not necessarily within their own area of major study. Each project is undertaken by a group of two or three students over a two-semester period supervised by an academic staff member. Although the project is not necessarily a statistical project, the number of the projects involving data analysis has kept on increasing every year (Loi & Lian, 1993; Loi & Wu, 1998). Hence, statistics has become a substantial part of the project. However, students have only done a module in statistics, which includes 24 hours of lectures and 24 hours of tutorials in the first year, and a module in research methods in the second year prior to the project work. The main concern is whether what they have learned in the modules is enough to equip them well for using statistical techniques in data analysis, and what difficulties they encountered.

The study is based on a survey that was conducted amongst the final year students in the academic year 2000-2001 upon completion of their projects. A questionnaire was designed to find out students' views of data analysis, statistical techniques used, difficulties encountered, and their likes and dislikes about the data analysis process. Comments and suggestions were also assessed. The questionnaire was put online and e-mailed to all the current final year business students in February 2001, after they submitted the projects to the School. Students were encouraged to answer the questionnaire online.

AN OVERVIEW OF THE PROJECT WORK

An objective of the project work is to develop students' research skills. When they work in society, students will encounter various problems that have no clear solutions and which may involve different degrees of research, making research skills to be of great importance (Adderley et al., 1975). The school has revamped its business courses since 2000, and more project-based assignments are used in various modules. Students will be exposed to research through the process of project work, which will prepare them for the challenges in a fast changing society. Research to explore the experiences of project work with undergraduates has been done (Bourner et al., 2001; Garvin et al., 1995). The results indicated positive outcomes from such practical work. Also there are a lot of studies showing that project work has a major role in statistical education (Boland, 1998; MacGillivray, 1998; Starkings, 1998). However, in the process of

researching a topic, students' views of data analysis should be explored. This is the objective of this paper.

FINDINGS AND DISCUSSION

Of the 1,300 final year business students, 251 questionnaires were completed and usable, representing a 23.9% response rate. The majority of respondents were female students (73.6%).

Data collection. The majority of the respondents collected data for their projects (89.2%). Most of them searched for the secondary data from the World Wide Web (79.6%), followed by journals (78.6%), newspapers (71.3%) and databases (66.2%). They also designed questionnaires and conducted surveys to collect the raw data; 57.8% via interview, 43.2% by mail and 34.4% via online.

Strengths: Use of several channels for data collection, which could save a lot of time.

Weaknesses: Did not have theoretical framework for questionnaire design, sometimes too ambitious and includes a lot of questions and multi-level of response scales.

Data summary. Most of the respondents used descriptive statistics such as mean, standard deviation and frequency tables summarizing the data (89.2%). About half of them used graphics for displaying data; 45.9% used pie charts, 54.1% used bar charts and 34.4% used line charts. However, only 1.2% used stem & leaf and 6.2% used box plot for data exploration.

Strengths: Most of them used graphics effectively.

Weaknesses: Not many used exploratory data analysis.

Data analysis. The basic statistical skills that have been taught in the first year statistics module were used widely in making inferences in a univariate analysis; 76.1% used *t*-test, 49.1% used correlation analysis, 45.7% used ANOVA, 42.9% used simple regression and 26.0% used χ^2 test. Although multivariate analysis is not covered in the basic statistics module, yet a substantial proportion of respondents used these techniques in the projects; there were 36.6% who used multiple regression, 29.2% used factor analysis and 14.8% used non-parametric tests.

Strengths: Most of them made use of what they have learned.

Weaknesses: Did not check the validity of using the tests for their data.

Difficulties. Although students have been guided on how to use the statistical software such as SPSS, Excel, etc., yet more than half of the respondents found that they were not familiar with the statistical package (66.3%), they did not know what technique(s) to use (65.1%), and did not know if the analysis and results were correct (58.7%).

Help seeking. Whenever they had a problem, most students would try to find solution on their own (67.6%) or textbooks (62.7%), then sought help from their peers (58.9%), or the project supervisor (56.6%). Lastly they consulted a statistical consultant if the problem(s) was still unsolved (31.1%).

The likes. Most of the respondents (81.1%) were glad to be able to learn something new, 74.5% found that they had an opportunity to analyse more practical problems in reality, and 16.2% showed that they enjoyed data analysis.

The dislikes. About 67.3% found that project work was tedious and 65.0% said it was time consuming, especially those who were not familiar with the statistical software, and 44.5% of the respondents showed that they did not enjoy data analysis.

Student Suggestions for improvement. Most of the respondents suggested that statistical skills could be improved by having more practical sessions (87.9%) while 73% recommended they should have more statistical projects as course assignments. Other suggestions included more hands on exercises; use of the earlier project work as examples; more statistical consultants in the School; more training in using software; and that the statistics course should be placed in the second year instead of the first year.

Student comments. The positive comments included that students felt satisfied if they could produce the statistical evidence that supports their results. They have a sense of achievement after obtaining the results for their projects; they have learned how to 'think' and obtained invaluable experience and knowledge in the process. Some negative comments were that they found that it is a time-consuming, monotonous job, which is very stressful.

CONCLUSIONS

Summary of findings. In general, students have been working hard on project work, especially in data analysis. Results showed that, in general, students were resourceful in the way on which they searched for data via various channels, summarizing data by graphics or tables, and knowing to use statistical inferences before decision-making. However, sometimes they were too ambitious in data collection ended up with a lot of unnecessary information; or they were too hasty and missed out some key factors. Results also showed that a low proportion of respondents used basic techniques for data exploration, and very few of them have studied the nature of data before analyzing. The most important issue is that more than half were not familiar with statistical software, did not know what skill(s) to use and did not know if the analysis was correct. They would lose confidence and interest in learning and hence found that it is tedious, time-consuming and boring work. Nevertheless, the frustration was compensated for by the enjoyment soon after they completed the work. Most of them were glad to have such an opportunity to analyse real life problems and learn something new.

Improvement. In order to help students conquer the difficulties, the School has made some changes in the statistics module since the project work system has been implemented:
- Having more practical sessions for tutorials so that students can have more time to explore the statistical software.
- Using more real-life business problems or case studies in tutorial assignments, and more open-ended problems for discussion so that students have an opportunity to apply what they learned in the lecture to the real life data.
- Amending the syllabus according to student needs. For example, introducing some advance level topics such as multiple regression analysis and non-parametric analysis to meet the needs.
- Using a flexible learning mode where subject outlines, handouts, tutorials, assignments, projects, etc. are available on the Internet Web page or Intranet, and the School Folders Section of Outlook. This provision allows students to acquire lecture-learning materials, even when unable to attend class and it has worked well for them (Loi & MacLaurin, 2000).
- Using open book examination with more open-ended questions to encourage students' statistical thinking rather than memory.
- Employing a statistical consultant to provide a useful resource and some guidance on the statistical issue at hand.

Besides statistics, more project-based assignments are being introduced to various modules. This increases students' chances of exploring data aspects of real problems that will enhance their confidence and competence when handling data. Although it is rather tough for a statistics teacher to teach a large number of business students who are not majors in statistics, the project work has provided another channel to promote the learning of statistics and to enhance the understanding of statistics via data analysis. The results of the study showed that more emphasis should be put on project work, not only to improve the statistics curriculum and assist students to master the statistical skill, but also to promote students' statistical thinking in future.

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