

Open-Book Examinations

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Abstract

A first year course, Business Statistics, was selected to be the first subject to implement the open-book examination in the School of Accountancy and Business, Nanyang Technological University. The objective of the study is to examine students' perception of the examination. A survey was conducted via a questionnaire after an open-book mid-term examination. The results based on 583 respondents out of 794 students, show that more than 60% of the students prefer the open-book examination to a closed-book examination. Students' preferences are only related to the major field of study. In particular, proportionately more respondents who major in Business as compared to Accountancy prefer open-book examinations. The reasons that statistically significant different are less time-consuming for preparation, less memorization and more room for creative thinking.

Open-book Examination

Introduction

Many countries are reviewing their educational systems and preparing to make changes in order to meet the needs of the economic and manpower demands of the 21st century (Han C, 1998; Novlan, F J, 1998; Li L, 1998). One of the directions is to improve the quality of education. In Singapore, this means that effort should be placed on developing students who are able to think independently and creatively and able to process the information analytically. Consequently, curriculum content and modes of assessment are being reviewed in Singapore. In order to develop creative and independent thinkers, more open-ended tasks that reflect real-life situations – questions involving problem-solving should be incorporated in examinations, especially for higher level education (Han C, 1998). The open-book examination is just one of several innovations that the government is steering the university and school system towards (The Sunday Times, 8 March 1998). As a result of the curriculum review on how students at different levels are taught and assessed in Singapore, more open book examinations would be introduced. The first open book examination to be implemented next year will be for A-level literature (The Straits Times, 22 March 1998). In some faculties at the National University of Singapore (NUS), besides trimming the undergraduate syllabus, there would be more open-book examinations (Han C, 1998). At the Nanyang Technological University (NTU), up to

30 per cent of examinations would be project-based and also some Schools have started to implement open-book examinations for certain courses.

A first year course, Business Statistics, was selected to be the first subject in Nanyang Business School at NTU to be examined under the open-book system in the academic year 1997-98. The discipline of this quantitative subject emphasizes understanding, thinking and application rather than rote memorization. Students do not have to memorize formulae. Previously, statistical tables and formulae were provided for the closed book examinations. Instead of providing sets of relevant materials, students were allowed to bring in their own, hence it was not an abrupt switching from closed book to open-book examination. The open-book examination was applied during the mid-term test as well as the final examination. In order to obtain students' feedback on the open-book system, a survey was conducted after the mid-term examination in 1997-98. Its objective was to find out to what extent students preferred this mode of assessment and their perceptions of the open-book examination.

This paper comprises four major sections. The next section reviews some of the studies related to the issues. Following that it discusses the research methodology employed and presents the data analysis and findings. The last section discusses the results of the study and suggests directions for future research.

Related Studies

Several studies related to open-book examination have been done. In their study, Theophilides and Dionysiou (1996) recorded that:

Referring to this type of examination Tussing posited as early as 1951 that the open-book examination “removes much of the fear and emotional block encountered by students during examination, while, at the same time, it emphasizes practical problems and reasoning rather than recall of facts”. Empirical research which followed Tussing’s postulate (Boniface, 1985; Feldhusen, 1961; Jehu, Picton, & Cher, 1970; Kalish, 1958; Krarup, Naeraa, & Olsen, 1974; Michaels & Kieran, 1973; Weber, Mcbee, & Krebs, 1983) affirmed this assessment of the open-book examination.

They also summarized the results of the above studies regarding the advantages and disadvantages of using the open-book examination: it does not lead to higher student achievement in terms of test scores, it reduces examination tension and stress, and it reduces rote memorizing.

In his article “Education for the Future”, Feller (1994) believed that to change education from educating our students to live in the past to the future, the open-book examination has necessarily to be implemented. The closed-book examination only demonstrates what students can do with whatever they have been able to memorize. In contrast, the open-book examination measuring high-level skills such as conceptualizing, problem solving and reasoning, corresponds almost completely to a total, real-world situation.

Theophilides and Dionysiou (1996) conducted surveys to examine the major functions and usefulness of the open-book examination. The results showed that students recognized that it called for the creative use of the knowledge gained, course content mastery, student self-evaluation and feedback, reduction of the examination stress and student self-regulation in studying the course. But these students' anxiety level and expected graduation grade did not influence by the major functions that students perceived significantly.

For comparing students' achievement, Loannidou (1997) found that there is no significant difference in total examination score between the students who took open-book examinations and those who took closed-book examinations. The open-book examination is not a better measure of different abilities than the closed-book examination when the examination is designed to address critical thinking and higher-order skills. The findings of this study suggest that other factors like the teaching-learning process applied throughout the course affect students' achievement. From this perspective, the open-book and closed-book examinations have their advantages and disadvantages.

A seminar on conducting open-book examinations was organized by the Centre for Development of Teaching and Learning at NUS in January 1997. The discussion of the panel members reached a consensus that open-book examinations are generally more suitable than closed book examinations for testing the application of knowledge to novel situations, as well as for testing higher order thinking abilities (Mohanani, K P, 1997)

These studies show that the open-book examination is increasingly becoming an essential evaluation tool in education, especially at university level, as its able to evaluate students' high-level skills such as conceptualizing, problem solving and reasoning (Bisse, 1993; Feller, 1994; Ioannidou, 1997; Theophilides *et al*, 1996). It is, therefore, worthwhile to study students' preference for this type of examination.

The present paper examines students' perceptions of the open-book examination. In particular, it investigates students' preferences for this kind of assessment by their background, examines their perceptions of the open-book mid-term examination and the reasons they gave for their preferences.

Research Methodology

Method

The survey was conducted via a questionnaire. The population of interest for the survey consists of students who registered for Business Statistics in the first semester, 1997-98. The students were informed at the beginning of the semester that both the mid-term and final examinations would be of the open-book type. They could consult the course textbooks, notes and any other reference books during the examination. They were also advised that the examination questions would require higher-order thinking in the form of practical questions and questions requiring analysis and synthesis. Hence, the mid-term examination was set differently from previous closed-book examination in such a way that would allow the students to exercise critical

thinking, to analyse an issue or problem, to probe into the knowledge, gained and to compare and contrast information obtained.

Questionnaire design

The questionnaire comprises two parts. There are five questions (Q1 –Q5) in part A and ten questions in part B (Q6 – Q15). The five questions in part A solicit information about student's gender, year of study, major field of study and origin of student (i.e., local or foreign). For part B, students were asked to respond to a series of questions related to the open-book mid-term examination. These include their course knowledge, experience in open-book examinations, perceived difficulty of the open-book mid-term examination, expected grade, and the number and usefulness of reference books brought in (Q9 to Q12). Question Q13 is the key item in the questionnaire: students were asked if there were a choice, which type of examination they would prefer. Students were also asked to give their reason(s) for their preferences in Q14 from the following:

- 1 Less time consuming for preparation
- 2 Less stressful
- 3 Less memorization
- 4 More room for logical thinking
- 5 More room for creative thinking
- 6 Other reasons (please indicate)

Finally the last question (Q15) is an open-ended question for respondents who wish to make a comment. The survey was done a week after the mid-term open-book

examination. The students were asked to the questionnaire anonymously during a tutorial session and to return it upon completion to their tutors. There was a total of 583 respondents out of 794 students. The response rate of the survey amounted to 73.4%. Among the respondents, there were 173 male students, making up 29.7% of the respondents.

Data Analysis and Results

Students' preferences

In the survey, students were asked to give their preferences for the open-book or closed-book examination and to give some background information which include gender, year of study, major field of study, origin of student, course background and experience of open-book examination. The distributions of students' preference for open-book versus closed-book examinations by the background information are summarized in Table 1.

Table 1: The Distributions of Students' Preference

Preference by Gender				
	Open-book	Closed-book	No Comment	Total
Male	107 (61.8%)	66 (38.2%)	0 (0%)	173 (100%)
Female	256 (62.4%)	151 (36.8%)	3 (0.7%)	410 (100%)
Preference by Year of Study				
First year	323 (61.8%)	198 (37.9%)	2(0.4%)	523(100%)
Repeat	40 (66.7%)	19 (31.6%)	1(1.7%)	60(100%)
Preference by Major Field of Study				
Accountancy	174 (57.0%)	131 (43.0%)	0 (0%)	305(100%)
Business	188 (67.9%)	86 (31.0%)	3 (1.1%)	277(100%)
Others	1(100%)	0 (0%)	0 (0%)	1(100%)

Preference by Origin of Student				
Local	333 (62.1%)	200 (37.3%)	3 (0.6%)	536 (100%)
Foreign	30 (63.8%)	17 (36.2%)	0 (0%)	47 (100%)
Preference by Course Background				
Have done the course before:	298 (61.3%)	187 (38.5%)	1 (0.2%)	486 (100%)
Have not done the course before	63(67.7%)	30 (32.3%)	2 (2.1%)	95 (100%)
No Comment	2 (100%)	0 (0%)	0 (0%)	2 (100%)
Preference by Experience				
Experienced	111 (68.5%)	51 (31.5%)	0 (0%)	162 (100%)
No experience	251 (59.5%)	166 (39.5%)	3(0.7%)	420 (100%)
No comment	1 (100%)	0 (0%)	0 (0%)	1 (100%)
Total	363 (62.3%)	217 (37.2%)	3 (0.5%)	583 (100%)

It can be seen from Table 1 that more respondents prefer open-book to closed-book examinations. The percentages are 61.8% for male students and 62.4% for female students; 61.8% for the first-year students and 66.7% for repeat students; 67.9% for students in the Business major and 57.0% for students in the Accountancy major; 62.1% for local students and 63.8% for foreign students; 61.3% for students who have done the course before and 67.7% for those who have not done the course before; 68.5% for students who experienced open-book examinations and 59.5% for students without such experience. Overall, 62.3% of the respondents prefer open-book to the conventional closed-book examinations.

A statistical test (*z*-test) on whether the proportion of the students who prefer open-book examinations is more than 60% was conducted. The result shows that more than 60% of the students prefer open-book to closed-book examinations at 2% significance level (*P*-value = 0.02).

In order to find out whether students' preferences of the two types examination are related to their background, the statistical tests on whether the preferences are independent to students' background were conducted. The Chi-square (χ^2) results are given in Table 2. The few responses indicating "No comment" and the only student majoring in "Others" are not included in the tests.

Table 2: The Results of Chi-square (χ^2) Tests

Students' Background	χ^2 value	<i>P</i>-value
Gender	0.57	0.811
Year of Study	0.762	0.383
Major Field of study	8.237	0.004
Origin of Student	0.034	0.854
Course Background	1.320	0.251
Self-assessed course knowledge	0.837	0.658
Experience	3.452	0.063

From the *P*-values in Table 2, it can be seen that the preferences for open-book examination or closed-book examination are not related to the gender, year of study, origin of student, course background and experience, but only significantly related to the major field of study (*P*-value = 0.004). In particular, proportionately more respondents who major in Business as compared to Accountancy prefer open-book examinations (see Table 1).

Student perceptions of the open-book mid-term examination

Students were asked to rate Q9 to Q12 by a five-point scale. The difficulty level of the examination, Q9, was rated with 1 denoting very easy, 2 easy, 3 just right 4 difficult and 5 very difficult. The expectation of their grades, Q10, was rated with 1 denoting excellent, 2 very good, 3 good, 4 fair and 5 poor. The number of the reference books

they brought with them for the examination, Q11, was rated with 1 denoting none, 2 one, 3 two, 4 three and 5 more than 3. The usefulness of the reference books, Q12, was with 1 denoting very helpful 2 helpful, 3 neutral, 4 not helpful and 5 not helpful at all. A *t*-test is used to test whether these perceptions were different for students who preferred one or the other examination mode. The descriptive statistics and the test results are shown in Table 3.

Table 3: Students' Perception of the Mid-term Examination by Preferences

	Open-book (N = 363)	Closed-book (N = 217)	<i>t</i>-value	<i>P</i>-value
Difficulty level perceived				
Mean	3.7237	3.9171	-3.209	0.001
Std deviation	0.6690	0.7217		
Expectation of the grade				
Mean	4.0634	4.0599	0.050	0.960
Std deviation	0.7424	0.8825		
Number of books brought with them				
Mean	2.1488	2.1060	1.183	0.237
Std deviation	0.4204	0.4225		
Usefulness of the reference books				
Mean	2.7548	3.4424	-8.592	0.000
Std deviation	0.9301	0.9367		

Note: The *t*-tests were performed assuming variances were equal.

The results in Table 3 show that the students' perceptions of the difficulty level and the usefulness of the reference book(s) they brought with them are significantly different for students with a different mode preference. The students who prefer closed-book examinations perceived the examination as being more difficult in terms of the mean scores than those who prefer open-book examinations. Likewise, these same students found that the reference book(s) brought with them during the

examination were not helpful while those who prefer open-book examinations found that the reference book(s) were helpful. Students expectation of the grades and number of books brought with them were not significantly different. The mean scores of the expected grade are close to 4.0. This implies that students expected a fair grade on average. The mean scores of number of books brought with them are close to 2.1, meaning that on average the students brought one reference book with them.

Reasons for the preferences

Students were also asked to give the reasons for their preferences in Q14 The distributions of the reasons given by their mode preference are summarized in Table 4.

Table 4: Reasons for the Preferences

Reason		Open-book	Closed-book	Total
1. Less time-consuming for preparation.	Disagree	207	208	415
	Agree	156	9	165
2. Less stressful	Disagree	188	120	308
	Agree	175	97	272
3. Less memorization	Disagree	34	211	245
	Agree	329	6	335
4. More room for logical thinking.	Disagree	259	153	412
	Agree	104	64	168
5. More room for creative thinking.	Disagree	293	193	486
	Agree	70	24	94
Total		363	217	580

Statistical tests on whether the reasons given are related to mode preference were conducted. The results of the Chi-square (χ^2) tests are given in Table 5.

Table 5: Test Results on whether Reasons are same for the Two Preferences

Reason	χ^2 value	<i>P</i>-value
1. Less time-consuming for preparation	100.588	0.000
2. Less stressful	0.671	0.413
3. Less memorization	429.785	0.000
4. More room for logical thinking	0.047	0.829
5. More room for creative thinking	6.764	0.009

The results show that the following reasons were significantly related to mode preference: less time-consuming for preparation, less memorization, and more room for creative thinking. In particular, 90.6% agree that they have less to memorize in open-book vis-à-vis closed-book examinations, 43.0% of the students who prefer open-book examinations agreed that it was less time-consuming for preparation; 19.3% agree that there is more room for creative thinking. The reasons "less stressful" and "more room for logical thinking" are not significantly related to the students' preferences

Besides the five major reasons listed in the questionnaire, students were also asked to indicate some other reasons they would like to be included.

Other reasons

For the students who prefer closed-book examinations 45% said that such examinations were usually easier, more direct, clearer and closer to the questions in tutorials and their textbooks. Furthermore, they could save on time needed to locate

the information they need to answer the questions during the examination. On the other hand, for students who prefer open-book examinations, 5% gave other reasons for supporting their preferences. They agreed that open-book examinations could truly examine what they really learnt and enhance their confidence. A student also stated that he/she hated rote learning which was what he/she would have to do for closed-book examinations for certain courses. He/she even suggested that if all subjects had open-book examinations, students would have a greater understanding of the subjects instead of producing “academic smart” grades.

Conclusions and Discussion

The analysis based on the response rate 73.4% of the survey, shows that more than 60% of the students prefer open-book to closed-book examinations. The preferences are not related to gender, year of study, origin of student, course knowledge and experience but only related to the major field of study. In particular, proportionately more respondents majoring in Business as compared to Accountancy prefer open-book examinations.

The analysis of the findings indicates that most students found that the mid-term examination was difficult, especially for students who prefer closed-book examinations. Students who prefer open-book examinations found that the reference book was helpful during the examination.

The analysis also shows that the reasons "less time-consuming for preparation", "less memorization" and "more room for creative thinking" are significantly different according to mode preference. In particular, for students who prefer open-book examinations, 90.6% agreed that there is less need for memorization in open-book examinations: 43.0% agreed it is less time-consuming for preparation but only 19.3% agreed that there is more room for creative thinking.

A few students who prefer open-book examinations stated that it tests students on their understanding rather than on their memory. But another student commented that although students were allowed to bring in books, it was not possible to refer to them during the examination because of time constraints. Hence there is still a need to prepare and to memorize course materials to a certain extent.

This was the first time an open-book examination was implemented in the School and it might be a new experience to many students. Furthermore, the kind of questions set for the mid-term open-book paper was different from that for previous closed-book papers, hence they perceived the difficulty and did not agree that the open-book examination reduces stress, especially for those who prefer closed-book examinations. Most students only brought one reference book with them for the examination. Since the bulk of reference materials for the course, Business Statistics, is mainly formulas, principles underlying and some examples only, one book would have been enough. They found that they did not have enough time to locate the information they needed to answer the questions.

Overall, more students prefer open-book to closed- book examinations. The findings of a positive response toward the open-book examination augurs well for extending such an examination to other subjects. It is essential to implement the system appropriately to match up with the subject, teaching and learning. As what has been pointed out: (Theophilides *et al*, 1996) the system will promote the ability to think rather than to memorize, reduce stress for the examinees, and encourage students to self-monitor their own learning if it is properly implemented. It could very well be the most effective way to improve our entire educational system and make it future-oriented (Feller, 1994). The teaching, whether it is compatible with open-book examinations, has to be continuously reviewed and improved, and greater effort is required to make it work. Further studies are needed in this area.

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Appendix

SCHOOL OF ACCOUNTANCY AND BUSINESS, NTU AB103 Mid-Term Examination Survey

Please circle the appropriate response.

PART A

- Q1 Your gender: 1 Male 2 Female
- Q2 Your current year in school:
1 First year 2 Second year 3 Third year 4 Fourth year
- Q3 Your major:
1 Accountancy 2 Business 3 Engineering 4 Others
- Q4 Are you a foreign student? 1 Yes 2 No
- Q5 If you answer to Q4 is "Yes", please indicate if you are from
1 Asean 2 Other country

PART B

- Q6 Have you taken any course in statistics before? 1 Yes 2 No
- Q7 How do you assess your statistical knowledge?
1 Above average 2 Average 3 Below average
- Q8 Have you sat for any open-book examination before?
1 Yes 2 No
- Q9 How do you find the mid-term examination?
1 Very easy 2 Easy 3 Just right 4 Difficult 5 Very difficult
- Q10 What grade do you expect to obtain in your mid-term examination?
1 Excellent 2 Very good 3 Good 4 Fair 5 Poor
- Q11 How many reference books did you bring with you for the mid-term examination?
1 None 2 One 3 Two 4 Three 5 More than three
- Q12 Do you find the reference book(s) helpful during the examination?
1 Very helpful 2 Helpful 3 Neutral 4 Not helpful 5 Not helpful at all
- Q13 If you have a choice, which examination would you prefer?
1 Open-book examination 2 Closed-book examination
- Q14 Give the reason(s) for your preference in Q13 (you may circle more than 1 reason)
1 Less time consuming for preparation
2 Less stressful
3 Less memorisation
4 More room for logical thinking
5 More room for creative thinking
6 Other reasons (please indicate): _____
- Q15 Please write any comments you would like to make about open book examinations.

Thank you very much for your feedback and co-operation.