

# The Impact of Open Book Examinations on Student Learning

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This paper aims to study the impact of open book examinations on the learning habits of students in the Nanyang Technological University in Singapore. A survey was conducted in order to ascertain whether students preferred open book examination and the reasons for their preference. The results of the survey showed that almost two-thirds of the students preferred open book examinations despite being more familiar with closed book examinations. They felt that preparations for open book examinations were less time-consuming and that they required less memorization and left more room for logical thinking. This article examines how open book examinations can be used to change students' learning attitudes and make the learning process more active.

## 開卷考試對學生學習的影響

本文主要在探討開卷考試對在新加坡南洋理工大學就讀學生的影響，通過抽樣調查探討學生是否比較喜愛開卷考試及喜愛的理由。調查結果顯示雖然學生習慣於閉卷考試，有三分之二的學生會選擇開卷考試。他們覺得應付開卷考試不需花太多時間準備，不需太多記憶，同時有更多的思考空間。本文也探討開卷考試怎樣改變學生學習的態度及使學習過程更靈活。

## **Introduction**

A closed book examination is probably the most common method of student assessment used in all levels of the education system in Singapore. Closed book examinations can be easily used to test students' abilities of storing-recall-reproduction, and understanding as well as knowledge. A closed book examination, if well-designed, can also be used to test a student's ability to think and apply his knowledge.

However, as we approach the end of 20th century, the goal and the mode of study have to change with the onset of the Information Technology (IT) age. Students no longer have to waste time on memorizing as an abundance of information can be acquired through various IT means. Our Prime Minister, Mr Goh Chok Tong, has urged the building of 'thinking Schools, Learning Nation' as we move into the 21st Century (Opening address at the 7th International Conference on Thinking, 1997, Singapore). Given the drive to improve the quality of education and the fact that information is now updated so rapidly, students must now move away from passive reading of prescribed texts to the process of acquiring skills for lifelong learning. This involves, in part, the ability to think critically and creatively (C. Han, 1998). Studies have shown that the use of closed book examinations is inappropriate in certain courses when these educational goals have to be achieved. This has led the Ministry of Education and tertiary institutions in Singapore to consider the use of an alternative assessment approach, i.e. an open book examination, in order to achieve the goals of promoting active learning and making Singapore a knowledge based economy.

In his article "Education for the Future", Feller (1994) pointed out that closed book

examinations only serve to demonstrate what students can do with whatever they have been able to memorize. The continued use of closed book examinations may encourage our students to live in the past rather than the future. Closed book examinations emphasize heavily on low-level skills such as rote memorization, instead of testing high-level skills such as the abilities to reason, conceptualize and solve problems. Furthermore, the use of a closed book examination only serves to test a student's ability to perform under very restrictive conditions. Once out of the classroom, the student will always have access to whatever resource materials are needed to solve the problem at hand. In this way, an open-book examination is able to almost completely replicate a real-world situation. Our education goal should therefore shift to focus on what students can accomplish if they are given the information at hand.

Hoffman (1996) noted that closed book examinations require memorization but little original thought. They force students to memorize information rather than understand concepts and as a result, students walk away from the class learning very little. Such examinations do not prepare the student for practical, real-life situations. On the other hand, open book examinations can be used to differentiate those who truly understand the concepts from those who have merely crammed the night before. As early as 1969, Bacon had already pointed out that the use of open book examinations encourages students to focus on ideas and concepts as well as methods and development, while at the same time, reducing the amount of knowledge which only needs to be remembered for an examination and which will probably not be required thereafter.

Singapore is reviewing its educational system and preparing to make the necessary

changes in order to meet the needs of the economic and manpower demands of the 21st century (Han C, 1998). On the education front, the focus is on improving the quality of education in Singapore. Efforts are being made to develop students who are not only able to process information analytically but also to think independently and creatively with curriculum contents and modes of assessment being reviewed in order to meet this goal. Having open book examinations is just one of several innovations that the government is steering the university and school system towards (The Sunday Times, 8 March 1998).

More open book examinations will soon be introduced in schools and higher education institutions. The Ministry of Education has planned to initiate open book examinations in the Advanced Level General Certificate of Education Examinations next year, with Literature as the first subject with this format (The Straits Times, 22 March 1998). More open book examinations will also be implemented in the two universities (Han C, 1998). Twenty-one per cent of the courses at the National University of Singapore (NUS) already have open book examinations with one quarter of these courses in the Faculty of Science alone (*Lian He Zao Bao*, 25 May 1998). No corresponding figures have been released by the Nanyang Technological University (NTU) as yet but several courses in the Engineering and Business Schools in NTU have had open book examinations for since 1997.

This paper aims to study the impact of open book examinations on student learning in NTU. In order to better understand the impact, a survey was first conducted on a group of students who had just completed a mid-term open book examination and a final open

book examination at the end of the semester. The objective of this study was to identify students' preferences of examination mode (open or closed book) and the reasons for their preference. Another objective was to study the impact of open book examinations on students' learning processes throughout the course.

This paper consists of four sections. The following section describes the methodology. Then followed by analysis of the major findings while the last two sections discuss student learning processes and how teaching methods have to be adjusted in the transition towards open book examinations.

## **Methodology**

### *Subject of the survey*

A quantitative first year module, Business Statistics, was selected to be the first course in the School of Accountancy and Business (SAB) to have an open book examination in academic year 1997-98. Business Statistics is a core module of both undergraduate programmes (the Bachelor of Accountancy (BAcc) and Bachelor of Business (BBus) programmes) offered by SAB. Students from these two programmes read this module in their first year at SAB. Therefore, most of the students surveyed were freshmen with a few repeat students.

In making a decision on which subjects are suitable for open book examinations, not only must the subject matter of the course be considered but also its goals and objectives (K. P. Mohanan, 1997). In this regard, Business Statistics would be the perfect choice for an open book examination because the aim of this course is to test the

students' understanding and ability in applying their statistical skills in analyzing data rather than merely memorizing and reproducing information given to them. Besides the semester-end examination, students were also assessed on the basis of a mid-semester test. This format of this test was likewise changed from a closed to an open book.

In the past, statistical tables and formulae were provided during the closed book examination in order to reduce the students' need for memory work. Now, these materials would be brought in by the students themselves. Hence, the change from closed book to open book examination was not such an abrupt one. However, the format of the questions which were set for the open book examination were different from those for the previous closed book examinations. For instance, questions with answers which could be copied from texts or prepared model answers were not used. Examples of such questions include those requiring the students to: "Compute. . . given that . . ."; "Construct the . . . for the following data . . ." or "Consider the model relating to . . . , find . . .". Instead, questions testing the students' understanding of statistical skills which required them to apply these skills in solving practical problems and making decisions on the basis of information they have not previously come across in their texts or lectures were used for the open book examination.

### *Survey*

The survey was conducted after the mid-semester test via a questionnaire. The questionnaire was designed to gather information on the students' backgrounds; their preference of examination modes (if they had a choice); their perception of open book examinations and the reason(s) for their preference.

The information gathered on the students' background included gender, year of study, specialisation, course background and experience. Questions on the student's perception of open book examinations included the level of difficulty and expected grade as well as the number of reference books and their usefulness.

For preferences, the students could select from the following categories:

- 1 Less time consumed for preparation
- 2 Less stress
- 3 Less memorization
- 4 More room for logical thinking

Lastly, an open-ended question was prepared for respondents who wished to make a comment.

## **Results and Analysis**

### *Sampling and Data Collection*

Of the entire cohort of 794 students, there were 583 respondents, giving a response rate of 73.4%. The majority of the respondents were female (70.3%). This was due to the fact that there are more female students who enroll in SAB's programmes every year. Almost all the respondents were freshmen (90%) as well as Singaporeans (92%).

### *Data Analysis*

Descriptive statistics were calculated for all variables. A series of *t*-tests was used to identify whether there were significant differences among the respondents' perception of the mid-term open book examination. Chi-square analysis was then used to identify whether there was any co-relation between the respondents' backgrounds and their preferences.

### *Students' preferences*

For the purpose of analysis, the students were grouped according to their preferences. The various distributions of students' preference for open book versus closed book examinations by background information are summarised in Table 1.

**Table 1: The Distributions of Students' Preference**

	<b><i>Open book</i></b>	<b><i>Closed book</i></b>	<b><i>No Comment</i></b>	<b><i>Total</i></b>
<b><i>Preference by Gender</i></b>				
<b><i>Male</i></b>	107 (61.8%)	66 (38.2%)	0 (0%)	173 (100%)
Female	256 (62.4%)	151 (36.8%)	3 (0.7%)	410 (100%)
<b><i>Preference by Year of Study</i></b>				
<b><i>First year</i></b>	323 (61.8%)	198 (37.9%)	2(0.4%)	523(100%)
Repeat	40 (66.7%)	19 (31.6%)	1(1.7%)	60(100%)
<b><i>Preference by Major Field of Study</i></b>				
<b><i>Accountancy</i></b>	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%)
<b><i>Preference by Origin of Student</i></b>				
<b><i>Local</i></b>	333 (62.1%)	200 (37.3%)	3 (0.6%)	536 (100%)
<b><i>Foreign</i></b>	30 (63.8%)	17 (36.2%)	0 (0%)	47 (100%)
<b><i>Preference by Course Background</i></b>				
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%)
<b><i>Preference by Experience</i></b>				
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%)
<b>Total</b>	<b>363 (62.3%)</b>	<b>217 (37.2%)</b>	<b>3 (0.5%)</b>	<b>583 (100%)</b>

A glance at Table 1 will show that more than 60% of the respondents preferred open book to closed book examinations. This is regardless of gender, year of study, origin of student and course background. A slightly higher percentage of students from the BBus programme (67.9%) preferred open book examinations as compared to 57% of the BAcc students. More of the respondents who have had previous experience with open book examinations (68.5%) preferred them to those who did not have such experience (59.5%). Overall, 62.3% of the respondents preferred open to closed book examinations. A  $z$ -test performed on the results showed that more than 60% of the respondents preferred open book to closed book examinations at a 2% significance level ( $P$ -value = 0.02).

Chi-square tests were then used to determine whether the students' preferences were significantly related to their backgrounds. The few responses indicating "No comment" and the only student majoring in "Others" were not included in the tests. The results of the tests are shown in Table 2.

***Table 2: The Results of Chi-square ( $\chi^2$ ) Tests***

<b>Students' Background</b>	<b><math>\chi^2</math> value</b>	<b>P-value</b>
Gender	0.57	0.811
Year of Study	0.762	0.383
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

The analyses indicated that the respondents' gender, year of study, origin of student, course background and experience were not related to their preferences. The only factor which showed a co-relation was the field of study ( $P$ -value = 0.004). Proportionately more respondents from the BBus programme preferred open-book examinations compared to those from the BAcc programme (see Table 1).

*Students' perception of the open book mid-term examination*

Students were asked to rank their perceptions of the mid-term examination on a five-point scale. The difficulty level of the examination was rated with 1 denoting very easy, 2 easy, 3 just right 4 difficult and 5 very difficult. The expectation of their grades was rated with 1 denoting excellent, 2 very good, 3 good, 4 fair and 5 poor. The number of the reference books the students brought with them for the examination was rated with 1 denoting none, 2 one, 3 two, 4 three and 5 more than three. The usefulness of the

reference books was rated with 1 denoting very helpful, 2 helpful, 3 neutral, 4 not helpful and 5 not helpful at all. A series of *t*- tests were used to identify whether there were significant differences among the respondents' perceptions of the mid-term examination, according to their preferences. The descriptive statistics and the test results are shown in Table 3.

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

	<u><i>Open book</i></u> (N = 363)	<u><i>Closed book</i></u> (N = 217)	<u><i>t-value</i></u>	<u><i>P-value</i></u>
<u><i>Difficulty level perceived</i></u>				
Mean	3.7237	3.9171	-3.209	0.001
Std deviation	0.6690	0.7217		
<u><i>Expectation of grade</i></u>				
Mean	4.0634	4.0599	0.050	0.960
Std deviation	0.7424	0.8825		
<u><i>Number of books brought for the examination</i></u>				
Mean	2.1488	2.1060	1.183	0.237
Std deviation	0.4204	0.4225		
<u><i>Usefulness of reference books</i></u>				
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 of the mid-term examination and the usefulness of the reference book(s) which they have brought for the examination are significantly different for respondents who have different preferences (*P*-values < 0.05). The mean scores of the students who preferred closed book examinations showed that they perceived the examination to be more difficult than those who preferred open book examinations. Likewise, the same students found that the reference book(s) brought with them for the examination were not helpful while those who preferred open-book examinations found that the reference

book(s) were helpful.

Students' expectation of grades and number of books brought for the examination were not significantly different by preferences ( $P$ -value  $> 0.05$ ). In both categories, the mean scores of the expected grades were close to 4.0. This implies that on average, both groups of students expected a fair grade. The mean score for the number of books which the students brought for the examination was close to 2.1, meaning that on average each student brought one reference book for the examination.

#### *Reasons for the preferences*

The distributions of the reasons given by the students' mode preferences are summarized in Table 4.

**Table 4: Reasons for the Preferences**

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

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

**Table 5: Test Results on whether Reasons are related to Preference**

<b>Reason</b>	<b><math>\chi^2</math> value</b>	<b>P-value</b>
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	6.764	0.009

The results show that reasons which were significantly related to mode preference are: less time-consuming for preparation, less memorisation, and more room for logical thinking ( $P$ -values  $< 0.05$ ). The reason "less stressful" is not significantly related to the students' preference ( $P$ -values  $> 0.05$ ).

Students who prefer open book examinations agree that such examinations will reduce the amount of time spent on preparation, make the learning process less stressful, require less memorisation and allow more room for logical thinking. In particular, of those who prefer open-book examinations, 90.6% agree that they have less to memorise as against 2.8% who preferred closed-book examinations, 43.0% agreed that it was less time-consuming for preparation as against 4.1% who preferred closed-book examinations.

#### *Other reasons*

Besides the four major reasons listed in the questionnaire, students were also asked to indicate other reasons for their preference.

Among the 583 respondents, 85 (15%) gave various other reasons for their preferences. Of the students who preferred open book examination, 18 gave other reasons to support their preference. Most of them agreed that open book examinations could truly examine what they had really learnt and enhance their confidence. A student also stated that

he/she hated rote learning which was what he/she would have had to do for closed-book examinations for certain courses. He/she even suggested that if all courses used open book examinations, students would have a greater understanding of the subjects instead of producing “academic smart” grades. For the students who preferred closed book examinations, 67 gave other reasons for supporting their choice. Thirty-six respondents from the BAcc course said that questions in closed book examinations were usually easier, more direct, clearer and closer to the questions in tutorials and textbooks. Furthermore, they could save on time needed to locate the information they required to answer the questions during the examination. This may be a factor why more respondents from the BBus programme preferred open book examinations.

### **Student Learning Processes**

Students are aware that the traditional learning strategies which they have used for closed book examinations will not be appropriate for open book examinations. They are also aware that they have to change their learning processes to develop different abilities for open book examinations. For instance, students used to study for closed book examinations by analysing past years’ examination questions, spotting likely questions that will be repeated, preparing for model answers to these questions and memorising them. However, all this changed after the open book mid-term examination. The students knew that unless they understood the concepts, they would not be able to pass the final examination as they would have no way to prepare model answers in advance.

Since then the students' study habits were observed during lectures and tutorials. Two phenomena were noted:

- Students were paying more attention during the lectures and making more notes. They organized these notes with labels and highlighters.
- Students became more active in discussion during tutorials. They were more prepared to interact with tutors.

The switch to open book examinations has made a noticeable impact on the learning habits of students. From the second phenomenon, it was heartening to see students adopting an active mode of studying. They started to challenge their teachers, ask questions, answer questions themselves, solve problems, argue and choose between alternatives. However with this change in the learning habits of students, teachers will have to change their method of teaching as well.

### **Teaching Methods**

To facilitate the shift to open book examinations, it is necessary to replace existing teaching styles with a more interactive mode of teaching. In the traditional style of teaching, teachers deliver a 50 minute lecture and students listen passively and take notes. In the students' mind, each lecture is analysed from the perspective of possible answers for potential examination questions. Students write down the points made by the lecturer on each topic, including the teacher's criticisms and reproduce the points in the final examination. This method of teaching is ideally suited if regurgitation is required in a closed book examination.

In an open book examination, the focus shifts from the reproduction of information to the processing of information. What this means is that the focus shifts to the testing of a student's abilities rather than his knowledge of course content. These abilities include the ability to apply a theory, test a hypothesis, propose an explanation, interpret the meaning, infer predictions, design an experiment and so on. We cannot help students develop these abilities by teaching. We require interaction to develop these abilities, students must interact actively with the teacher, instead of merely listening passively.

### **Conclusions and Discussion**

The analysis of the survey conducted after the mid-term examination shows that more than 60% of the students preferred open book to closed book examinations; more of these students came from the BBus programme and that they found that reference books were helpful during the examination. However, there was no significant difference in the expected grades between those who preferred open book and those who preferred closed book examinations. The results of the survey coincide with the findings of Ioannidou (1997) in that there is no significant difference in achievement between students who took either open or closed book examinations.

The analysis of the survey also showed that the number of respondents who chose the reasons "less time-consuming for preparation", "less memorization" and "more room for logical thinking" differed significantly according to mode preference. In particular, 90.6% of students who preferred open book examinations agreed that there is less need for memorization in open book examinations; 43.0% agreed that it is less time-

consuming for preparation but only 19.3% agreed that there is more room for logical thinking. A few students who preferred 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 used in SAB and it is a new experience for many students. Furthermore, as the type of questions set for the mid-term open book test was different from that for closed book examinations, students had to prepare themselves accordingly and did not agree that open book examinations reduced stress. This was so especially for the minority who preferred closed book examinations. Most students only brought one reference book with them for the examination and they found that they did not have enough time to locate the information they needed to answer the questions.

Another phenomenon worthy of note is that the students' learning processes are changing. They know that spotting, preparing and memorizing answers will not work for open book examination. As for teachers, we have to adjust our methods of teaching to help students move away from rote learning.

In conclusion, more students preferred open book to closed book examinations. Such a positive response towards open book examinations augurs well for extending such examinations to other subjects. It is essential to implement the system appropriately in

line with changes in courses, teaching and learning. As was pointed out by Theophilides (Theophilides *et al*, 1996), the open book examination system, if properly implemented, promotes the ability to think rather than to memorize; reduces stress for the examinees and encourages students to self-monitor their own learning. Together with appropriate changes to teaching methods, it could well be the most effective way to improve our education system and make it one for the 21<sup>st</sup> century (Feller, 1994).

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(Received 1.6.99, accepted 5.7.99, revised 27.7.99)

Improving student learning implies improving the assessment system. Teachers might assume that it is their teaching that directs the students' learning, but students orient themselves as learners in relation to what will be assessed. But the impact of assessment on how teachers teach might be even more significant than its impact on how students learn, particularly if we take into regard the impact of teaching on student learning (Trigwell and Prosser, 1999?). In this paper the core issue is the impact of assessment on learning. On the other hand, the course was open for students who were not going to study at the university and quite a lot of the students had no intention of university studies. Impact on Learning Strategies. Open book examinations promotes the right mental set in both learning and teaching. The students will stop mugging to reproduce it in tests. Open book examinations will effect a fundamental change in this attitude. When the teacher announces an open book test, most students breathe a sigh of relief, because they think they're getting a break from studying. It is entirely a wrong notion. In fact, open book tests are not simple. This paper explores the impact on students' learning of a change in assessment in a materials science course for engineers. The theory behind the move is discussed with reference to previous work on developing deeper approaches to learning in students at university. The relationship between university students' approaches to learning and preference for the open- and closed-book examinations was investigated for 144 Greek undergraduate (56 third- and 88 fourth-year) students attending a Philosophy, Education and Psychology Department. The approaches were explored by the Approaches and Study Skills Inventory for Students (ASSIST). Examination preferences for open- or closed-book exams were assessed by 3 self-report questions.