

Full Length Research Paper

Comparison between invigilated and non-invigilated online exams

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This paper compares the invigilated online exam with the non-invigilated 'open book-open web' (OBOW) examinations. An intranet based invigilated and another internet based non-invigilated OBOW exam was conducted, wherein 116 students participated in it. The result obtained in the invigilated exam was compared with the non-invigilated exam taken by the same students. The percentage of marks obtained by the students were graded as "A" for 90-100% marks, "B", "C", "D" and "F" for 80-89%, 70-79%, 60-69% and 0-60% respectively. Some students were placed under ungraded category ("U" grade), as they faced some technical problems during the exam. Cheating was assessed based upon the time at which the student started taking the exam, the total time taken to complete it and the marks they scored. The results indicated that there was enormous difference in the results between the two types of exams. The number of students scoring "A" and "B" grades were very high in the non-invigilated exam as against the invigilated exam. A few cheating cases were observed in both the types of exams, which is unavoidable in any circumstance. About 4 students faced technical problems in the online non-invigilated internet based exams. The technical problems encountered were loss of internet connection, slowing of the internet connection due to traffic congestion in the network, hanging of the user's computer system. It was concluded that non-invigilated online exams would be better in accessing the student's ability to understand the subject and reproduce it, as compared to invigilated exams.

Keywords: Open book open web non-invigilated examination, closed book invigilated examination, online exams, authentic assessment, constructivism.

INTRODUCTION

There are varying challenges to the present medical educators than their ancestors, in imparting medical education to the future physicians (Ruiz, 2006). Vast development in the health care deliverance and enormous progress in the medical field has pressurized the academicians, thus there is a consequential short time for educating them as compared to the past (Ozuah, 2002). The present scenario has changed with relation to the delivery system for health care, wherein there has

been shifted from acute care to community-based care for chronic diseases. This resulted in variation in the educational settings (Nair, 2003). The present curricula in most of the medical schools have already challenged to cover conventional materials; hence it becomes difficult for the teaching faculty to find time to teach new fields such as genomics, palliative care, geriatrics and complementary medicine. The modification of the curricula towards competency based learning; accentuate the learning outcome rather than the learning itself (Leung, 2002).

Online education and examination system uses the internet tools to convey a wide spectrum of solutions that

Table 1: Summarized overall difficulty index for the questions in relation to the answers given by all the students

Difficulty Guide	Difficulty index	Number of questions			Average
		Group I	Group II	As perceived by the instructor	
Easy Questions	> 80 %	8	7	11	8.66
Medium Questions	30 % to 80 %	7	8	4	6.33
Hard Questions	< 30 %	0	0	0	0

augments understanding and execution of the knowledge (Rosenberg 2001; Wentling, 2000). In some instances, No in-person interaction takes place over the length of the course (Joi, 2011).

E-learning can be used by medical educators to improve the efficiency and effectiveness of educational interventions in the face of the social, scientific, and pedagogical challenges noted above. It has gained popularity in the past decade; however, its use is highly variable among medical schools and appears to be more common in basic science courses than in clinical clerkships (Moberg 1999; Ward, 2001).

The university teaching has been uniform for many centuries, without much change in the pattern of its imparting education. However there has been a revolution in the past two decades in the essence of university education. Due to increase in the number of the students undertaking higher education, the student profile has changed culturally, socially and economically due to which there has been an extravagant change in the educational methodology and technology (Carrier, 1990).

The professional journals and conferences dedicated to teaching and learning have been influenced by these changes and has produced relentless course of literature on various research topics viz. modes of flexible delivery, experiments with new classroom techniques, online pedagogies and use of multimedia (Sims, 2004).

Whatever changes might have taken place in the university teaching, ultimately the student has to be examined at the end of the course. The examination systems in most the university at present is by use of pen and paper. When the system of education has changed, then the closed book- invigilated exam, which is commonly used in various universities today, does not seem to fit with the modern learning technologies. Thus an 'open book-open web' (OBOW) non- invigilated online exam must be a superior method of assessment (Lam, 2007). Yet, in this system also the chances for cheating are estimated to be more or less the same. Therefore the best option would be to choose for the examination

students rather than alienate them (Theophilides, 2009). The opportunity for academically dishonest practice is less because of the way these examinations are structured, but so is the temptation to resort to this kind of behaviour in the first place (Boniface, 1985; Herrington, 1998). Students readily relate to the task that lies before them as they can see the point of it. By contrast, the closed book, invigilated exam encourages a strategy of 'cramming' the night before and 'data-dumping' on the day, with little knowledge retention thereafter. The OBOW exam, meanwhile, is thoroughly grounded in an authentic context, and learners have an opportunity to apply their newly constructed knowledge in a meaningful way.

A position frequently adopted by those defending the continued use of closed book, invigilated final examinations is to state that students will cheat unless they are supervised. This assumes (i) that cheating is an easy thing to do within the OBOW model, and (ii) students do not cheat in invigilated examinations. Both assumptions are challengeable, and have been tested in earlier research (Williams, 2004).

METHODOLOGY

We conducted two exams online with one hundred and sixteen (116) students at College of Medicine, King Khalid University, Abha, Kingdom of Saudi Arabia. One of the exams was invigilated and the other was non- invigilated exam.

Invigilated Exam: The invigilated exam was conducted online through the intranet in the university campus eLearning labs during working hours. It comprised of fifteen (15) multiple choice questions, out of which ten (10) were easy and another five (5) were medium questions. Questions were prepared using Quizmaker version 6.2. **Table1** shows the difficulty index of the questions as analyzed by the software (Blackboard version 6.2.2) and that perceived by the instructor. We allotted a total time of twenty five (25) minutes to answer

Table 2: Comparison of the number of students in the two groups, scoring different grades in invigilated verses non-invigilated online exams

Groups	Grades → Number of students scoring the grade						Type of Exam ↓
	A	B	C	D	F	U	
Group I	9	9	4	4	7	0	Invigilated
(N = 33 girls)	15	14	3	0	0	1	Non-invigilated
Group II	20	33	9	13	8	0	Invigilated
(N = 83 boys)	32	30	6	8	4	3	Non-invigilated
Overall	29	42	13	17	15	0	Invigilated
(N = 116)	47	44	9	8	4	4	Non-invigilated

A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = 0-60%; U = Ungraded due to technical problems

these fifteen questions. Only one attempt was allowed and the system was set to auto-submit the exam when were compelled to login all at a time and start the exam all at once. To avoid extensive cheating, the students were compelled that once started, the exam must be completed in one sitting. The system presented the all the questions at the same time as a single web page.

Non-Invigilated Exam: Non-invigilated exam was made open online using the internet facility outside the University working hours, when the students will be at their residence. It comprised of fifteen (15) multiple choice questions, out of which ten (10) were easy and another five (5) were medium questions.. Questions were prepared using test-maker available with the Blackboard version 6.2.2. Table1 shows the difficulty index of the questions as analyzed by the software and that perceived by the instructor.

We allotted a total time of twenty five minutes to answer these fifteen questions. Only one attempt was allowed and the system was set to auto-submit the exam when the time expires. The exam was open for a total time of one hour. Students had to option to login anytime during this duration. To avoid extensive cheating, the students were compelled that once started, the exam must be completed in one sitting. The system presented the questions one at a time and backtracking was prohibited, wherein the students were prevented from changing the answer to a question that has already been submitted. Furthermore, the questions and the options for the answers were appearing to each of the student in random order. Thus, these options minimized the possibility of cheating, though the exam was not invigilated.

A total of 116 students belonging to first year undergraduate Medicine (M.B.B.S) participated in each of

the time expires. The exam was open for a total time of one hour. As this was an invigilated exam the students these exams. These students were categorized into two different groups as described under.

(1) **Group I:** Thirty three (33) female students. This group was considered as non cheating group, because during odd hour's females in Saudi Arabia are not allowed to out to other houses. So each of the female students took the exam independently by herself. Off-course the girls might have contacted each other over phone or social networking media, but this was minimized by giving limited time to answer the questions.

(2) **Group II:** Eighty three (83) male students. This group was considered as a probable cheating group, because it is but natural that most of the boys, if not all, will sit together in groups, to take the exam.

The percentage of marks scored by each of the student in different groups were analyzed and compared with the marks obtained in these two types of exams. The marks obtained were graded wherein students obtaining 90-100 percent marks were graded as "A" grade. 88 – 89 % as "B" grade, 70 – 79 as "C" grade, 60 – 69 as "D" grade, 0 – 59 as "F" (fail) grade. Students who faced technical problems during the non-invigilated exam were not graded and were included under "U" category (Ungraded).

The authors interviewed each and every student personally after the exam to evaluate and to get their views regarding the pros and cons of both the invigilated and non-invigilated exam and to note their grievances, if any. Further, the online attempt by all the students in the non-invigilated exam was analyzed by the instructor to scrutinize the degree of cheating and / or difficulties faced by the students during the exam. Cheating was assessed based upon the time at which the student

Figure 1: Comparison of the number of students scoring different grades by group I students in invigilated verses non-invigilated exams

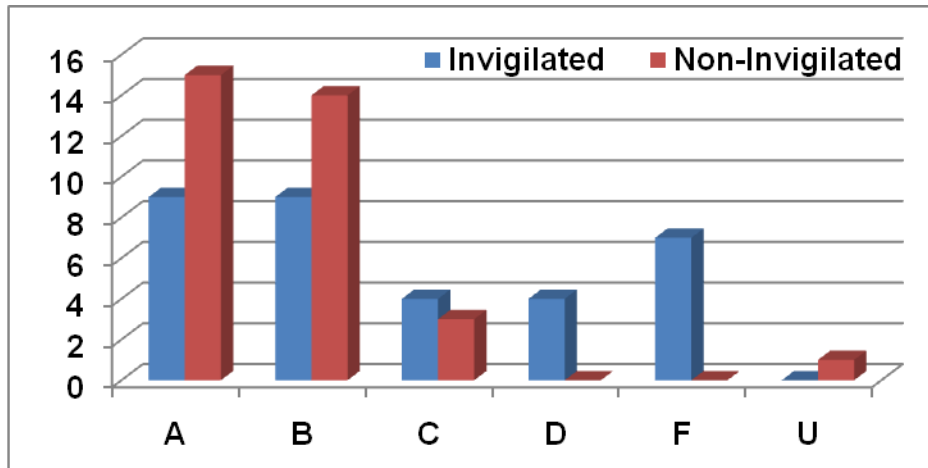
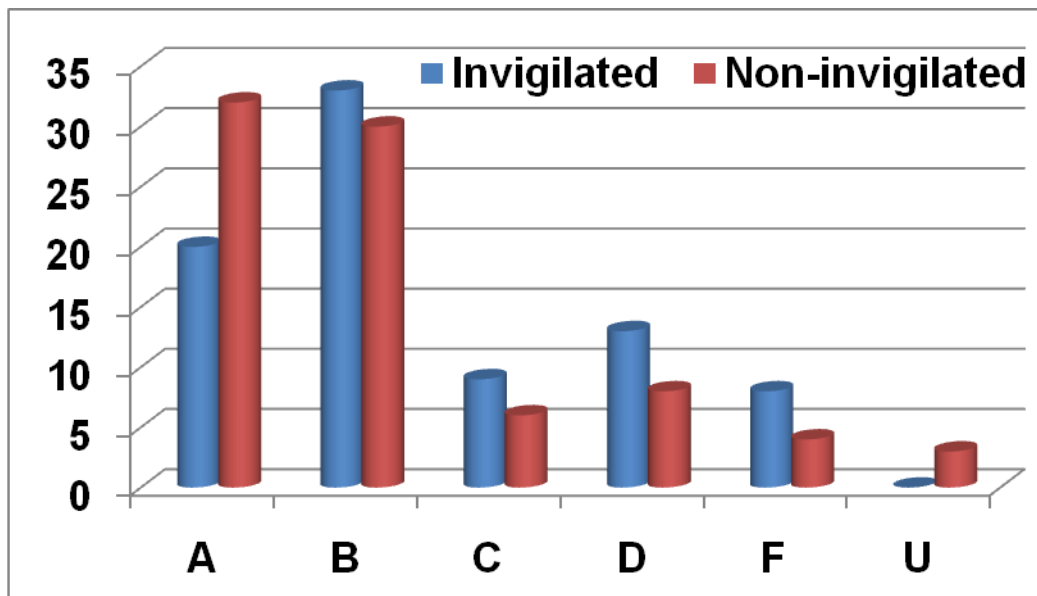


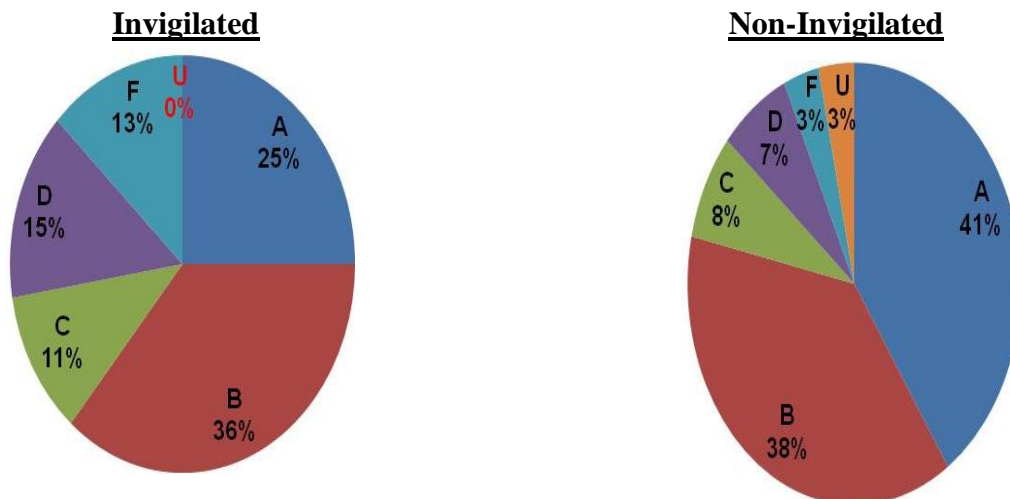
Figure 2: Comparison of the number of students scoring different grades by group II students in invigilated verses non-invigilated exams



started taking the exam, the total time taken to complete it and the marks they scored. The number of question

not attempted by the student in relation to the total time taken by the student to submit the exam was used as an

Figure 3: Overall comparison of the percentage of students scoring different grades by both the group of students in invigilated verses non-invigilated exams



index to evaluate the technical problems during the exam.

Statistical Analysis

We analyzed the data using the automated data analysis available in the Blackboard version 6.1.3, existing over the eLearning server for the staff of King Khalid University, Abha, Kingdom of Saudi Arabia. The parameters analyzed by this software included difficulty index of the questions, average score, standard deviation and standard error.

RESULTS

The number of students scoring different grades in invigilated and non-invigilated exams are presented in [Table 2](#).

Group I girl students performance in the invigilated exam was very pitiable when compared with the non-invigilated examination wherein only nine (9) girls scored the topmost "A" grade in the invigilated exam as against fifteen (15) girls in the non-invigilated exam. The number of students scoring lower grades increased successively in the invigilated exam as compared to non-invigilated exam. The number of students scoring B, C, D and F grades in the invigilated exam were 9, 4, 4 and 7 respectively, whereas 14, 3, 0 and 0 students scored B, C, D and F grades respectively in the non-invigilated exam ([Figure 1](#)).

Group II student's performance in the non-invigilated exam was far better as compared to the non-invigilated examination wherein thirty two (32) students scored the uppermost "A" grade in the non-invigilated exam as against twenty (20) students in the invigilated exam. The number of students scoring other grades was less in the non-invigilated exam as compared to invigilated exam. The number of students scoring B, C, D and F grades in the invigilated exam were 33, 9, 13 and 8 respectively, whereas 30, 6, 8 and 4 students scored B, C, D and F grades respectively in the invigilated exam ([Figure 2](#)).

Looking into the overall performance of both the group of students in invigilated and non-invigilated exam, it is observed that there is enormous difference in the results. 41 % (n=116) of the students scored "A" grade in the non-invigilated exam as compared to 25 % in the invigilated exams. Further grade "B" was also outnumbered in the non-invigilated exam (38%) in comparison to the invigilated exam (36%). The percentage of students scoring B, C, D and F scores in the non-invigilated exam were 8 %, 7 %, and 3 % respectively contrary to 11%, 15%, and 13% respectively in the invigilated exam. It can be observed that a high degree of failures occurred in the invigilated exam, which was not the case with non-invigilated exam ([Figure 3](#)).

Cheating

We documented a total of four (3.5 %) cases of cheating in both the groups during the non-invigilated exam. The ground on which it was accomplished that these students might have indulged in cheating is offered in methodology

section above. As expected, there was only one case of cheating among the girls (Group-I) and three among the boys (group-II). The authors came across a similar number of cheating cases during the invigilated exam, wherein some grumbling among the male students was observed. These students were warned, and no other action was taken against them.

Technical Problems

The technical problems faced by the students included dropping of the internet connection, slow internet connection, problem with the browser, user computer very slow or totally stuck-up etc. About four students faced technical difficulties during the non-invigilated exam. However no technical problems were noticed during the online invigilated exam as it was conducted over the intranet, the computer systems were well set to take the exam with a compatible browser in all the systems for the exam module.

DISCUSSION

The main purpose of examining a student at university level is to measure how much he/she knows about the subject being examined. It is neither meant to filter the students nor to harass them. Advancement in the teaching methodology in the last few decades has driven many scholars to devise newer and enhanced methods of examining the students, open-book open web (non-invigilated) exam being one among them. In-order to examine the caliber of a student it is very much necessary to have good and standard questions, so that an extraordinary intelligent student can answer all of them perfectly well. A student with a medium talent can make through most of it, if not all and a poor student can strive hard to solve at least some of the questions and get through the exam. While preparing the questions it must be kept in mind the type of exam being conducted. An invigilated paper pen exam can have uniform questions all through. As a rule a non-invigilated online exam should contain an assortment of easy, medium and hard question in the ratio of 2:1:1, so as to avoid cheating and plagiarism, as it will be an open-book-open-web exam. However in the present study this rule was not followed, because we wanted to compare the results with the same type of questions in both the invigilated and non-invigilated exams, hence we prepared the questions in the ratio of 3:1:0 :: easy : medium : hard questions. The result was obvious; more number of students scored "A" grades in the non-invigilated exams as against the

invigilated exams. Furthermore, the number of students scoring "B" grades in the non-invigilated exam also outnumbered the invigilated exam.

A good result should, nevertheless exhibit a bell shaped curve. Among our results, the invigilated exam for both the groups showed a curve near bell shape, which is an example of excellent system of examination. But the non-invigilated exam did not show any such curve instead it exhibited a steep declining curve from A to F grades.

Based on the results of this study, it can be said that in order to conduct a non-invigilated online exam certain criterion has to be followed, as mentioned below.

- (1) The questions are made in the ratio of 2:1:1: easy: medium: hard. Hard questions must include thought provoking, problem solving and case oriented questions.
- (2) The time allotted for the exam should be just enough for an average student to complete the exam.
- (3) The total time an exam is available to a user should not be much more than the allotted time for the exam. If the time allotted for the exam is 45 minutes the test available to the user online should not be more than 60 minutes.
- (4) The software should not allow the student to begin the exam 10 minutes after the start of the time of the exam to minimize cheating.
- (5) The questions and answers (in an MCQ) should be displayed in random order and backtracking should be prohibited. The exam should be auto submitted on expiry of the allotted time.

On the issue of opportunities for cheating, the result is also the same; namely, that there are broadly similar opportunities (Williams, 2006) may it be either invigilated or non-invigilated exam. This is counter to the commonly held view that information technology provides new situational opportunities for dishonest behavior (McMurtry, 2001), and that, as a result, cheating should be made easier, faster, and more convenient, as students can share exam information via chat rooms, plagiarize from the internet, or share exam questions via email between classes (Kleiner, 1999). This view has been supported in a study conducted by Chapman et al, in 2004, which reported that a relatively high percentage of students have already been involved in academic dishonesty in a web-based testing situation. In this study, even though non-invigilated exam was ranked slightly higher on this occasion, cheating does not emerge as an important indicator. Factors which are considered most important in favour of non-invigilated exam are flexibility regarding the location of the exam; a format relevant to business/professional education, suited to student's

learning style, quality of learning outcomes, and intellectually challenging (Williams, 2007). Cheating can be totally avoided if the number of questions added to the test is 4-5 times more than the actual number of questions that a student needs to answer. For instance an exam requiring students to attempt 15 questions should contain 100 questions and thus the probability of 4-5 student getting the same question is very meager.

The only and the major drawback that the authors observed in the study was the emergence of technical problems during the exam time. About 4 students faced technical problems due to improper technical knowledge of the students. The students are unaware of the choice of right browser to be used for such exams, the correct browser settings, deleting the browser history (temporary internet files, cookies, in Private filtering etc.) prior to taking the exam. The main culprit of computer system using internet service was simultaneously running the enormous background programs, which hampers the smooth running of the user's computer. An antivirus program was another hindrance to take an exam that deploys questions one after the other in a uniform fashion. Appearance of harmonized web page one after the other from the same site is sensed as a virus by an antivirus program, hence the antivirus program stops the display of further pages from the web site. Therefore many students experienced termination of the exam after attempting few questions. In addition to these technical problems in the user's computer, the internet service provider in the area where this exam was conducted is not well developed. The internet connection drops completely intermittently or becomes very slow because of over usage by some other users in the network due to excessive amount of the data transfer, causing traffic congestion on the network. Moreover the time of examination in the present evaluation, was the prime time for the usage of internet by all users in the network, thus it's obvious that the internet will be very slow or will completely cut off. As the examination in review was not a final exam, it did not affect the carrier of the students. Hence, an online non-invigilated final exam cannot be conducted through the internet, until and unless it is confirmed that all the students are aware of the technical problems that could arise during such an exam and the means to rectify them before hand. Furthermore, the internet service provider should be perfect in providing uninterrupted internet connection to the users.

University examinations continue to be dominated by closed book, invigilated pen and paper tests. It is argued here that this is something of an anachronism given the human capital needs of a knowledge economy, not just

because of the absence of technology that is used routinely in everyday business and commerce, but because this type of examination instrument is incompatible with constructivist learning theory that favours deep learning (Ioannidou, 1997). It is further argued that a commitment to authentic assessment will pave the way for a different type of final examination, where real-world problems are allowed to take centre-stage, and multi-media can be harnessed to provide the learner with a more engaging experience. With greater engagement, this, in turn, can yield better results in terms of the depth of student learning (Feller, 1994).

Importantly, non-invigilated open-book-open-web exam is a transferable model that can just as easily be administered in an on campus setting as online, and while there will always be a small number of students who will cheat, the main priority should be to focus on the higher quality learning outcomes of the majority, rather than set up an entire system to stop a small minority. Certainly, if there is roughly equal scope for cheating then it would make sense to opt for the model that maximizes student learning (Theophilides, 2000).

CONCLUSION

We finally concluded that non-invigilated online exams would be better in accessing the student's ability to understand the subject and reproduce it, as compared to invigilated exams.

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