

# Comparison of Effectiveness of Computerized and Conventional Fixed and Learning Module in Undergraduate Pathology Teaching

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## Abstract

**Introduction:** Fixed Learning Module (FLM) adopted in pathology teaching to medical undergraduates, encompasses exhibition of potted specimens and charts. Though it is an important teaching method it also has its limitations. **Aim:** To create an alternative method for teaching pathology using web based, interactive computer technology [i.e., computerized FLM (compFLM)] and to evaluate its effectiveness in pathology teaching compared to conventional FLM (convFLM). **Method:** ConvFLM materials were selected from the pathology museum while compFLM was prepared using digital photographs of potted specimens and java script which was then uploaded into the institute's intranet. A class of medical students was divided into two groups, each exposed to either type of FLM in the female reproductive block (FRB) with a cross over in the subsequent musculoskeletal block (MSB). Students completed a questionnaire and were subjected to an assessment at the end of each block, consisting of multiple choice questions (MCQ), computerized objective structured clinical examination (OSCE) and conventional-style OSCE questions. **Results:** Analysis of examination results showed neither teaching method to be superior. However students found compFLM more interesting, user friendly and easily accessible. **Conclusion:** Computerized FLM has many advantages. However it cannot replace conventional FLM and both techniques would be complementary in effective learning.

**Key Words:** Fixed Learning Module, Medical, Teaching

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## Introduction

Fixed learning module (FLM) is an important method used for teaching pathology in the integrated system practised in medical schools. The pathology input in FLM is predominantly in the form of exhibition of potted specimens and display of charts on pathophysiology, etiology, pathological features, complications and relevant photomicrographs.

In conventional FLM, gross features of potted specimens are demonstrated by the pathology lecturer to groups of students. As the number of students increased, this method was considered ineffective and closed circuit television (CCTV) was used as an added mode of teaching. However, this method too had its drawbacks in that gross pathological features could not be fully appreciated when seen as two-dimensional images on the TV screen.

In the current era of computer and web-based technology, a multimedia presentation with interactive features would provide an interesting and effective teaching tool. Only a few websites on basic and systemic pathology for undergraduates are currently available on the internet.<sup>1,2</sup> Before implementing this new teaching method in our institution, it was only appropriate that it be evaluated against the existing conventional method with respect to its effectiveness, feasibility, advantages and disadvantages.

The aim of this study was to initially create a computerized FLM (compFLM) teaching module in pathology for undergraduates. This method was then tested against conventional FLM (convFLM) by objective assessments. The hypothesis is there is a difference in the effectiveness in pathology teaching between conventional FLM and computerized FLM.

## Methods

### Materials

The Female Reproductive Block (FRB) and Musculoskeletal Block (MSB) modules were selected for this study. The resource material for convFLM included 59 potted specimens in FRB and 28 in MSB, photomicrographs and charts. CompFLM was created using the digital images of the potted specimens and photomicrographs exhibited in convFLM. The images were edited and pathological features were highlighted using the image editing software. The interactive features and web pages were created using Microsoft FrontPage software.

### Subjects & Procedure

A class of 198 medical students in their third year was selected and divided into two equal groups. During the FRB teaching module, one group of students was instructed to attend the convFLM in the laboratory where a pathology lecturer undertook teaching in the usual manner. The web page for FRB was uploaded into the university intranet and the URL address informed to the second group of students who attended only the computerized FLM at the computer-aided instruction (CAI) laboratory, library or hostel. There was no resource person available for the second group.

At the end of FRB, both groups of students answered a questionnaire on variables pertaining to the FLM. They were also assessed by Multiple Choice Question (MCQ) and Objective Structured Clinical Examination (OSCE). The MCQ paper consisted of 20 single statement questions of true/false type. A correct answer scored 1 mark while a wrong answer was given a 0. In the OSCE component three questions were based on pictures of conventional potted pathology specimens (convOSCE) and another three on computerized pictures (compOSCE), projected on a screen. Each OSCE question was allotted 4 marks.

During the Musculoskeletal Block module, the groups crossed over. While the compFLM group was given the URL address for MSB, the other group attended convFLM only. At the end of MSB a similar assessment with a new set of questions pertaining to MSB was conducted. A questionnaire on comments of both types of FLM was also given.

The co-researcher, blinded to the type of FLM students were exposed to, corrected all MCQ and OSCE answer scripts of both blocks. The marks were tabled using SPSS programme. The data obtained from the questionnaire were entered in the same file correspondingly.

### Statistical analysis

The scores of MCQ, conventional OSCE and computerized OSCE were reported as mean and standard deviation (SD). The mean differences of the scores between the conventional and computerized FLM groups were tested using *independent t-test*. All tests were 2-tailed with a *p* value of 0.05 or less considered statistically significant.

## Results

### FLM on Female Reproductive Block

One hundred and sixty three students participated in the assessment at the end of FRB. Ten students were excluded from the study as they attended both types of FLM. Hence the questionnaire and assessment were evaluated for 153 students, comprising 78 students in the conventional FLM group and 75 in the computerized FLM group.

In the MCQ component, 46.2% of the convFLM group passed. The marks ranged from 3 to 17, with a mean of 10.0 (SD 2.70). In the compFLM group, the marks ranged from 4 to 16 with a mean of 10.2 (SD 2.84). Forty eight percent of the students passed this component. The results between the groups were not statistically significant ( $p = 0.613$ ).

In the convOSCE assessment, the marks ranged from 2 to 12 for the convFLM group with a mean of 8.2 (SD 2.63) and a 78.2% pass rate. In the compFLM group, the marks ranged from 0 to 12. The mean was 7.5 (SD 2.59) and 70.7% of the students passed. The difference was not significant ( $p = 0.109$ ).

In the computerized OSCE component, the marks ranged from 0 to 12 in the convFLM group with a mean of 6.1 (SD 2.87). Forty one percent of students passed. In the compFLM group, the marks ranged from 0 to 10. The mean was 4.9 (SD 2.68) and only 32% of the students passed. This difference was significant ( $p = 0.009$ ).

#### ***FLM on Musculoskeletal Block***

One hundred and one students participated in the assessment at the end of MSB. Twenty-nine students were excluded from this study as they attended both types of FLM. Statistical analysis was evaluated for 72 students, comprising 37 students in the conventional FLM group and 35 in the computerized FLM group.

In the MCQ component, 81.1% of the students in convFLM group passed with marks ranging from 2 to 18 and a mean of 12.0 (SD 3.22). In the compFLM group, 88.6% of the students passed with marks from 7 to 20 and a mean of 13.8 (SD 2.95). There was a significant difference ( $p = 0.021$ ) between the groups.

In the conventional OSCE, both convFLM and compFLM groups obtained marks from 0 to 12 with a mean of 7.2 (SD 3.74) in the conventional group and mean of 6.8 (SD 3.87) in the computerized group. There was a 67.6% pass rate in the convFLM group and 45.7% in the compFLM group. However this difference was not significant ( $p = 0.735$ ).

In the computerized OSCE component, both convFLM and compFLM groups scored marks from 0 to 12 with a mean of 7.8 (SD 3.15) in the conventional group and mean of 8.1 (SD 3.50) in the computerized group. Seventy three percent of the convFLM and 74.3% of the compFLM students passed respectively. However there was no significant difference ( $p = 0.753$ ) between the groups.

#### ***Questionnaire Results***

In convFLM, less than 10% of students returned to the laboratory to review the FLM materials after the scheduled session. However in compFLM, 33% of students accessed the pathology website twice and 8% more than twice.

Majority of students (63%) spent less than an hour at the convFLM sessions while in compFLM 44% spent more than 1 hour at their computer. The students used computer facilities available in the CAI lab and about 20% also utilised the library and other places where intranet facilities could be accessed.

The students' impression on both types of FLM was evaluated by a questionnaire based on interest, user friendliness, resource person, easy understanding, interaction with resource person or computer, usefulness and preference (Fig. 1).

Eighty percent and 64% of students encountered problems during convFLM and compFLM sessions respectively. Non-availability of resource person was faced by 22% and 35% of students in convFLM and compFLM respectively. About 49% of convFLM students found the resource material unclear while only 24% of compFLM students felt so. The CAI lab was not freely accessible to 29% of compFLM students while 20% encountered a similar problem with the convFLM laboratory.

Other problems faced by students in convFLM included overcrowded laboratories, the need for better written description of gross specimens, difficulty in understanding certain lecturer's accent, inferior quality of the audiovisual system and the need for the laboratory to remain open after office hours.

In compFLM, students' problems included insufficient number of computers in the CAI lab, inability to gain access to the URL files, difficulty in concentrating while in front of a computer, unsatisfied with 2-dimensional pictures and the need of guidance from a lecturer. On the other hand,

compFLM pictures were considered clear and self-explanatory and immensely helpful during revision.

Majority (79% of 53 students) wanted both types of FLM to be practised. They wished to inspect real three-dimensional specimens and receive information from the attending pathologist.

## Discussion

The effectiveness and general impression of the students towards a novel computerized FLM method was evaluated in this study.

Few websites are available providing simple and appropriate learning material. Using our own institution specimens was deemed to be advantageous in FLM teaching. The primary author took twelve months to prepare the compFLM materials. Relevant information from literature was considered in experimenting and creating this web-based teaching software.<sup>3</sup>

In FRB, there was no significant difference between the mean MCQ marks in the two groups. However in MSB, the compFLM group scored significantly higher than the convFLM group. It is impossible to prove that gain in theoretical knowledge was influenced solely by the teaching method. It may depend on many other factors, including other learning techniques, students' intelligence and ability to consolidate information gained during the FLM sessions.

There was no significant difference between the mean convOSCE marks of both student groups in both FRB and MSB. Interestingly the convFLM group achieved a higher mean mark and higher pass rate in compOSCE component of FRB assessment. This suggests that compFLM alone was inadequate and the students needed to appreciate pathologic features of specimens during convFLM. Plausible reasons include unclear perception of 2 dimensional images on the computer monitor and absence of a resource person.

Thus no conclusion could be drawn on which FLM method was superior in pathology education. However the compFLM appeared to have certain advantages and generated enthusiasm among students. Students were able to spend more time for compFLM compared to convFLM and study at their own pace and convenience. This was also reflected by a better attendance rate (more than 55%) during the self study sessions.

ConvFLM resource material was not well understood, as mentioned by 61% of students in FRB and 37% of students in MSB. Moreover students in convFLM were not keen to review resource material after the scheduled FLM session especially when there was no lecturer present.

The advantages and enthusiasm towards compFLM were clearly evidenced by the higher percentage of students who felt that compFLM was more interesting, user friendly and effective than convFLM. If given a choice of one, 56.4% of students preferred compFLM while only 10.9% preferred convFLM.

Though many studies project enthusiasm and improvement in student participation and satisfaction with the use of computer-assisted instruction, few are able to clearly demonstrate actual improvement in medical education over traditional modalities.<sup>4,5</sup> In the present study the computer-aided instructional packages designed by the authors have undoubtedly shown a favourable impact on the students.

In conclusion, learning pathology through computerized FLM has added advantages compared to conventional FLM though not necessarily superior in imparting knowledge. It cannot replace but would certainly complement conventional FLM in undergraduate medical teaching.

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Figure 1. Comparison between conventional and computerized FLM from the students' perspective.

