



COMPUTER-BASED “TEACHER-LESS” THEORY CLASS IN MICROBIOLOGY- A PILOT TRIAL

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ABSTRACT

The country-wide shortage of medical teachers in several pre- and para-clinical disciplines, calls for development of ‘stand-alone’ teaching modules which can replace them, wherever at all possible: our Microbiology department put together audio-visual power-point slides for one module of topics. These “teacher-less” classes were conducted for a batch of undergraduate students, in a case-control randomized format of study. Results of their attitude (qualitative) and performance scores (quantitative) were tabulated and analyzed and are presented here. Comparative literature is also discussed.

KEYWORDS : computer-based instruction, microbiology theory module, audio-visual class, microbiology teaching, educational intervention



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INTRODUCTION

Since the last few years, due to far-reaching changes in National policy for Medical Education, the country has seen a wide and rapid expansion in number and distribution of medical colleges across the land. This has generated the shortage of teachers in many medical subjects, especially in the pre- and para-clinical sciences. Development of 'stand-alone' teaching modules can offset this lack, and international experience supports the usefulness of such efforts. Medical Council of India Regulations on Graduate Medical Education 2012 not only prescribes teaching hours for each subject but also prescribes specific hours for different teaching-learning methods in each subject, and has earmarked the number of teaching hours for *self-directed learning*; in Phase II it is 124hrs.¹In consonance with this approach, the department of Microbiology undertook a project where the Objectives were :

- * to design a teaching module incorporating computer software , for delineated portions from undergraduate curriculum
- * to deliver this educational intervention, as a pilot-trial, to the students within the normal course of study
- * to obtain objective evaluation of its efficacy, and

* to obtain feedback on effectiveness and acceptability of the "new" method

METHODS

At the outset, One audio-visual class was conceptualized, and a power-point presentation of the topic was created, with audio files synchronized to the text and figures, and the whole auto-advanced sequence was timed to run for 45mts. This was presented as a trial run for the senior students and department faculty, and yielded comments and corrections, i.e. feedback for refining the methodology. The actual Theory-teaching module was then prepared, with 7 topics from Parasitology, with inputs and voice-recordings by 3 teachers. A qualitative test was developed, which was a 20-statement attitude questionnaire graded by the respondents on a 5-point Likert scale, to measure student perception and acceptance. For Quantitative evaluation, pre-and post-tests of MCQ-type were made ready, [Item analysis and grading was done], and Validity/Reliability testing on prepared questionnaire was done.

Figure1

Extract from 5-point Likert-Scale Questionnaire used in evaluation of CD-classes

Some statements about the CD-classes you attended, are given below. Please give your opinion about each statement in the blanks provided. Please use these responses only – strongly agree / agree / undecided / disagree / strongly disagree.

1. The CD-class encourages us to attend theory classes. _____.
 2. There is ample coverage of each topic in the CD-class _____.
- [... 20 items]

These topics were then taken as classes for the 2nd year Batch [N=85], in the normal course of the curriculum. Roll numbers were randomly allocated by computer to obtain 2 groups: test and control cohorts; the first receiving the conventional teacher-led class, and the second receiving the "teacher-less" audio-visual presentation concurrently. Intervention was done over a 3-week span,

the quantitative tests being administered, at the beginning and end of the set of 7 classes. The whole intervention was completed within 4 weeks. After the post-test, the control-cohort was shown the intervention module also, to establish that there was no ethical inequality in the teaching of the class as a whole. Findings were tabulated and analyzed.

RESULTS

QUANTITATIVE

Pre-Test was given to both groups, before the intervention. The Post-tests were done after completion of the module. The Pre-test scores of the two groups, were not statistically different, thereby indicating that the control and intervention groups were comparable. Post-test scores comparing the *%change in performance*, in the two groups, of each subject, were as follows:

Test-cohort Control-cohort

Mean	1.20	5.67
SD	3.42	3.41
SEM	0.68	0.80
N	25	18

Pvalue and statistical significance

The two-tailed P value equals 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant. Therefore, the CD-classes were *not as effective* as conventional teaching

QUALITATIVE

Average score is assigned “undecided” if between 2.5 and 3.5

- Students’ opinion (overall) about the CD-classes :

against a possible maximum total score of 100, the cohort’s average score = 50

This indicates a neutral response to the new format of ‘teacher-less’ Theory classes.

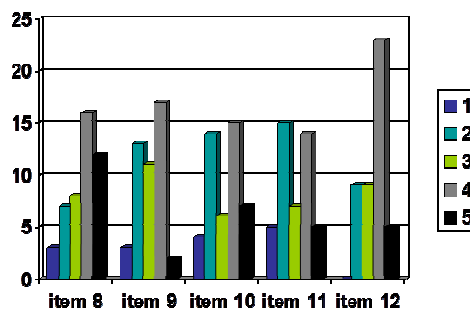
- Students’ opinion regarding *good effect on learning behavior* [statements 1, 10, 14, 15, 18]: 2.31

Indicates disagreement

- Students’ opinion regarding *general administration* of CD classes [statements 5, 7, 20]: 2.62
- Students’ opinion regarding *content* of CD classes: [statements 2, 3, 11, 12, 17]: 2.72
- Students’ opinion regarding *reliability* of CD classes: [statements 6, 9, 19]: 2.70
- Students’ opinion regarding *comparison/ preference* between conventional & CD classes [statements 4, 8, 13, 16]: 2.25

Indicates disagreement

Figure 2
Examples from tally of Likert-scale scores obtained



Informal feedback

Free comments by the students, (which we solicited on the anonymous attitude questionnaire sheet) included the following: they “enjoyed” the recordings and animations, and “learned a lot”. The majority of the Faculty also responded similarly. Students came forward, and *asked to be “studied”*, and gave very wise constructive feedback, even accepting that un-supervised learning was definitely desirable, even though they “were not ready for it yet.”

DISCUSSION

Joyce et al² have described 4 types of models for educational interventions: social models, personal models, information processing models & behavioral models: this last type sees students as a collection of learned behaviors, and it is adjudged most suitable (and common) of all the models for large classes including large lectures. The methods within this model include the familiar ones such as direct instruction, self-instruction (e.g. self-paced study kits or workbooks), training & simulations etc.; our present intervention would be of the type: ‘programmed instruction’. While many teachers from our country’s medical colleges do incorporate widely-available instructional material into their classes, in the form of charts, models, web-images etc., many others still restrict their presentation to chalk-and-blackboard, with minimal graphics, and little or no color and animation. In accordance with our latest educational policies, modernization and optimal utilization of information technology is sorely needed to galvanize Medical Education. The options for Web-based education range from the use of applications in traditional classrooms to comprehensive online courses in which there is no face-to-face contact.³ Western medical schools are facile with web-based teaching-learning, and they transfer the major burden of learning to the students, by asking them to prepare from online courses, websites and free software. A “hybrid” course is one that utilizes a combination of the traditional classroom format and distance learning via the Web.³ ‘Blended learning’ includes learning activities that involve a

systematic combination of co-present (face-to-face) interactions and technologically mediated interactions between students, teachers and learning resources.⁴ Computer-aided instruction usually refers to auto-tutorial software that delivers information in a step-by-step linear mode.⁵ CBI (Computer Based Instruction) can also provide advantages over text for learning different kinds of information. Nicholls et al⁶ showed that students who viewed animated auto-tutorials better understood complex, dynamic processes (example: how respiration generates ATP) than students who used text-based information.⁵

Coming to the present intervention, our results suggest that while the students’ opinions were neutral regarding the administration, content and reliability of our educational intervention, they were *not in agreement* about it having a positive effect on their learning behavior, and *not agreeable* to the conventional classes being replaced by CD-classes. Also, their post-test shows poorer performance by the test-group as compared to the control group. This would mean that their grasp and comprehension was less, in the absence of a teacher. This is an expected drawback of a self-directed learning module, where there is no opportunity for the audience to ask questions, to have doubts clarified, or to otherwise interact with the resource person. Though the students’ informal feedback reflects that they were interested and happy with their participation in this experimental study, the results analysis compels us to conclude that the module was not effective in delivering the desired result of learning and acceptability equivalent to conventional teaching. Within this subject, many workers have obtained good results by using various types of intervention to enhance both theoretical and practical learning. Amane et al found clearly that students preferred lectures utilizing PowerPoint presentations, compared to OHP or blackboard teaching.⁷ Kukkamalla et al employed various Self Directed Learning (SDL) strategies in Microbiology, like Discussion and presentation, One key point / One key word recollection, Multiple True False (MTF) questionnaire / Programmed questionnaire and Pathway MCQ’s.⁸ Sancho

et al published a study which showed that the students achieved similar grades in the modules whose initiation was in the virtual laboratory with no previous instruction in the real laboratory, to the grades they achieved with the modules whose complete or partial initiation took place in the real laboratory.³ This extends “teacher-less” instruction in Microbiology beyond the lecture-hall, to the laboratory as well. Johnson envisaged an inclusion of web-based quizzes to prepare before examinations, as indicated by student web usage logs. The dependent variable was their score on the statewide final examination. Results supported her hypothesis that students who use preparation modules online score higher on the final examination than students who do not. Moreover, students who prepared online scored higher on questions designed to test synthesis of knowledge and analysis of data.⁹

Taylor & Chow report that their Microbiology and Infectious Diseases module and the Immunology module both adopt integrated multidisciplinary approaches, and achieve superior results in student learning.¹⁰ We suspect that our test-classes were perhaps technically imperfect, due to inferior sound quality of the voice-recordings as well as paucity of graphic illustrations. Also, the module was administered very near an Internal assessment test, and the students were irregular in attendance, as well as distracted during these ‘un-supervised’ classes. Lastly, the small number of participants gave a result which probably does not reflect the true effect which a larger group would have shown. These thoughts echo the advice and warning of the NTTC: “In the present age of information revolution and penetration of technology and ICT in all fields of education where medical education is not

an exception, it is to be taken care that technology or ICT should be not used indiscriminately or not to be used just for the sake of application because application of technology or ICT is highly context-dependent.⁴ Even in international pedagogy, experts opine that “Of the different types of CBI, there are mixed results about whether or not any one kind enhances learning. For computer-aided instruction, with or without such features as graphics or animation, studies show both a positive effect and no effect on learning.”⁴

CONCLUSION

While our present study findings were equivocal at best, indications are that by fine-tuning our modules, and timing the intervention better, with larger class-sizes, we could obtain superior results in performance and attitude from the students. We were successful in motivating, enthusing and convincing medical faculty in our institution, into incorporating use of computer software and technology into their skill-sets. The students have been introduced to a more self-directed way of education, and remain open to potential gains from such modules. We hope to build much more effective audio-visual packages to positively impact Microbiology teaching-learning in the future. Up-gradation of teaching technology throughout the curriculum, when validated by further such studies, can and must be made a desirable goal, by the curriculum-planners, and the Managements of Medical institutions. Implementation of advances in teaching-learning strategy will go toward making medical education progressive, innovative and ergonomic.

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