Usefulness of a Self-learning CD-ROM Module for Teaching Biostatistics in the Community Medicine Curriculum

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ABSTRACT

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Teaching of biostatistics in the community medicine curriculum is facing some issues such as shortage of trained faculty and inadequate teaching time. Various methods utilizing modern information technology have been studied to overcome these problems. We attempted to study the use of self-learning CD-ROM module for teaching biostatistics in the community medicine curriculum and evaluate the effectiveness in a group of third-semester medical students. The self-learning CD-ROM on biostatistics developed by the World Health Organization has been designed in such a way that trainees can work independently using only the CD-ROM when no book or tutor is available. The module was pilot tested on 30 fifth-semester students in two batches, each posted for 2 weeks in community medicine. The first batch was the control and the topics taught them only in the conventional method while for the second batch, the test group given with digital module. Acceptance of this module was assessed using a 5-point Likert scale questionnaire for the students. Actual knowledge acquisition was evaluated using a post-test for the two groups. The analysis revealed that majority of the students in the test group were comfortable using the module and felt that it encouraged them toward further in-depth self-learning on the concerned topics. The results from the post-test were compared between the test and control groups using the Student's t-test, which gave a P value of 0.091 (5% significance level)suggesting that the difference was not significant and had comparable effectiveness. To conclude, we would like to suggest that the use the concept like computer skill labs coupled with an interactive information technology based self-learning module might be helpful in the teaching of biostatistics in the community medicine curriculum.

Keywords: Community Medicine, Biostatistics, Self-learning CD-ROM Module, Information Technology, E-Learning

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INTRODUCTION

Biostatistics is taught along with the subject of community medicine in the undergraduate medical curriculum. Teaching of biostatistics in the community medicine curriculum is facing issues such as shortage of trained faculty, inadequate teaching time, and the inappropriate teaching-learning methods. Various methods utilizing modern information technology have been studied to overcome these problems. The self-learning digital module developed by the World Health Organization has been designed in such a way that the students can learn biostatistics independently using the CD-ROM when no book or tutor is available. The broad topics covered into the modules are description and presentation of data, statistical measurements, parameter estimation, comparison tests, rate-ratio-proportion, and indices in epidemiology and the performance of diagnostic tests. It also included a self-assessment and self-scoring system. The module can be introduced in the undergraduate medical curriculum preferably for the third semester or fourth-semester students posted in the community medicine. Before introducing it for teaching biostatistics in the community medicine curriculum, the usefulness and effectiveness of the self-learning digital module and its acceptance among medical students has to be evaluated through a pilot test along with a control group taught in the conventional method.

It is evident that the analysis of much of the research in the health sciences depends on advanced statistical

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methods. These facts increase the requirement for bio-statistical understanding among health professionals, especially the fresh medical graduates. Biostatistics is taught along with the subject of community medicine in the undergraduate medical curriculum. Teaching of biostatistics in the community medicine curriculum is facing issues such as shortage of trained faculty, inadequate teaching time, and the inappropriate teaching-learning methods. Various methods utilizing modern information technology have been studied to overcome these problems. Apart from this, the undergraduate students in their 2nd year of medical college have little motivation and need for biostatistics but may have a strong motivation to use the computer. These student skills and attitudes are suggesting us to use the computer based modules to enhance the learning of biostatistics in the medical curriculum. Furthermore, the use of computers is encouraged in teaching to allows the student to concentrate on the interpretation of the analysis rather than on arithmetic calculations.

OBJECTIVES

To study the use of self-learning CD-ROM for teaching biostatistics in the community medicine curriculum and evaluate the effectiveness in a group of third-semester medical students.

METHODS

The self-learning digital module in biostatistics was pilot tested on 60 third-semester students in two batches, each posted for 6 weeks in community medicine. The first batch was the control and the topics taught them only in the conventional method while for the second batch, the test group given with digital module.

Broad topics covered into the modules are as follows:

1. Description and presentation of data
2. Statistical measurements
3. Parameter estimation
4. Comparison tests
5. Rate-ratio-proportion and indices in epidemiology
6. Performance of diagnostic tests.

It also included a self-assessment and self-scoring system

Acceptance of this module was assessed using a 5-point Likert scale questionnaire for the students. The level of knowledge acquired was evaluated using pre and post-tests for the two groups.

Table 1: Students' feedback

Feel comfortable in using SLD module (%)	7	13	47	33	0
SLD module is a better method than conventional Lecture class (%)	13	7	27	47	7
Use of SLD module encouraged me to learn more about biostatistics (%)	0	27	33	27	7
Content of the module require modifications (%)	0	7	27	60	7
Questions used for self-assessment scoring are familiar (%)	0	20	40	40	0
Feel better equipped in biostatistics after using this module (%)	0	13	40	40	7
Online tutorial support will enhance its usefulness (%)	0	0	27	60	13
Feels SLD module as a good innovative experience (%)	0	0	13	54	33
SLD modules can be repeated in other medical subjects (%)	7	27	7	40	20

RESULTS

The analysis revealed that 53% of the students feel that self-learning digital modules are a better method than lecture class. But only 33% were comfortable in using the module and 36% felt that it encouraged them toward further in-depth self-learning on the concerned topics. 67% favored modifications in the content of the module, to turn it into more useful and effective. 40% agree the questions for self-assessment and scoring used in the module, were familiar to them. 47% students believe they are better equipped after using the module and 73% believe that an online tutorial along with the self-learning digital module will enhance its usefulness. The self-learning digital module was a good innovative experience for 87% of students **(Table 1).**

The results from the post-test were compared between the test and control groups, using the Student's t-test, which gave a P value of 0.494 (5% significance level). The difference between the two groups was not statistically significant. There is a significant improvement in the level of knowledge acquired ($P < 0.001$)as per the scores of the pre and post-tests in both the groups. Mean change in the level of knowledge acquired for the conventional group is 2.28 and that of the study group is 1.86. The comparison of the mean change in the level of knowledge acquired gave a P value of 0.477, also shows the difference is not statistically significant.

DISCUSSION

Medical schools have long recognized the need to revise their teaching methodology but have been slow to change.[1] Nageswari et al. adopted Modern trends in the medical education with a paradigm shift from the con-

ventional classroom teaching methods to non-conventional teaching aids so as to encourage interactive forms of learning in medical students through active participation and integrative reasoning.[2] The recognition that computers should play an increasingly important role in medical education is a key element. They should be viewed as more than multimedia instructional programs and must include medical informatics applications that are part of clinical practice.[3] The concept of integrated teaching and self-learning will be greatly facilitated by the advances in information technology. There have been various studies attempting to utilize modern informatics tools in teaching medical subjects and biostatistics.

Diomidous et al. developed a module to help to design courses with different levels of knowledge regarding epidemiology and students to get acquainted with the field of epidemiology which has been evaluated by both graduate and undergraduate to prove the efficiency of multimedia in teaching the rather difficult subject of Epidemiology.[4] The evaluation of an instructional anatomy dissection software for the use of medical students indicated that the software was useful, easy to use, and improved the students' experience in the dissection classes.[5] The effectiveness of Web-based multimedia contents for Physical Examination and Health Assessment on learning achievement was studied and was found that to maximize the effectiveness of the teaching process when used as a teaching aid, and yet kept the strength of a face to face teaching and learning method.[6]

Basturk demonstrated the educational advantages of Computer Assisted Instruction and he suggest participants' learning capacity of the introductory statistics could be improved successfully when Computer Assisted Instruction used as a supplement to regular lecture in teaching introductory statistics course.[7] Azer et al. assessed student learning before and after use of the multimedia CD-ROM. Students agreed that the assessment tools used in the program and the feedback provided were meaningful and helpful to their learning.[8]

A computer-assisted multimedia training course was developed for intravenous injection and evaluated its effect on the knowledge and self-perceived performance of intravenous injection for novice nurses by Tsai et al. They concluded that the training course had a significant effect on the intravenous injection's knowledge. Besides, a high rate of satisfaction for the multimedia program showed the self-developed program was successful.[9] Prinz et al. found that the use of 3D animations leads to a better understanding of difficult surgical topics among medical students.[10]

The instructional interactive multimedia program was found to be at least as effective as the standard lecture of the orthodontic curriculum for undergraduate training in orthodontics. Aly et al. compared the effectiveness of an interactive multimedia courseware package versus standard lectures regarding knowledge, understanding, and transfer of content, as well as problem-solving skills in orthodontics.[11]

Jeffries et al. compared the effectiveness of an interactive, multimedia CD-ROM with traditional methods of teaching the skill of performing a 12-lead ECG.[12] When compared self-learning outcomes using the software and the printed materials, there were no significant differences between the two groups in self-learning measures. Text-based learning seems to be a convenient educational method because it can be used at any time in any place. However, with more time and facilities available, CD-ROMs may be as effective as traditional learning methods and can be an alternative tool.[13]

Lewis investigated the utility of computer-assisted learning (CAL) for teaching anatomy and physiology and was found that CAL provides an effective supplement to conventional methods of teaching, particularly in subjects such as anatomy and physiology. CAL also provides the student with an important additional resource and facilitates alternative modes of learning that are well suited to the requirements of students in subjects allied to medicine.[14]

Messecar et al. developed a statistics CD-ROM tutorial program to replace a classroom course with several self-study modules. In which the overall satisfaction with the CD-ROM for students who used all the components was improved substantially, compared to the Web-based delivery method.[15]

Roesch et al. developed an interactive multimedia program for dermatological education and completely integrated into the regular dermatological curriculum of five German medical schools. The formative evaluation of an implemented relational database revealed a high learner acceptance regarding the program's instructional design, ergonomics, and didactical presentation and, after completion of Dermatology 2000, increased interest in the medical education software. It is concluded that the implementation of CAL in present medical curricula can contribute to reformations of medical education. The instructional design of Dermatology 2000 is well-accepted and suitable to provide both theoretic biomedical knowledge and clinical skills.[16]

The effectiveness of a series of Web-based, multimedia tutorials on methods of human body composition analysis were examined by Buzzell et al. showed that Web-based tutorials are as effective as the traditional lecture format for teaching these topics.[17]

A thoughtfully designed computer program can replace a standard lecture in a pediatrics curriculum when comparison made between them. Students using the computer program were more accurate than students attending the lecture when scoring drawings and estimating a developmental age from them.[18]

Various studies show medical students enjoyed learning with various kinds of computer-based supplementary materials, and video lecture faced statistical challenges.

CONCLUSION

The results show that the use of self-learning CD-ROM for teaching biostatistics is as good as the conventional lectures. There was a significant improvement in the level of knowledge acquired as per the scores of the pre and post-tests in both the groups. The majority of students feels that the self-learning digital modules are a better method than conventional lecture class, but they favor modifications in the content and presentations of the present module. Most of them believe an online tutorial coupled with the self-learning module will enhance its usefulness. The usefulness and effectiveness of self-learning digital modules can be improved by including short videos, interactive games, short puzzles, online assignments, etc. Students wanted to repeat the method of self-learning digital modules in other medical subjects. The modules shall be made more user-friendly, through wide discussions with students and faculty.

We would like to suggest the concept like the use of computer skill labs coupled with an interactive information technology, and web-based self-learning methods might improve the teaching of biostatistics and other subjects in the medical curriculum.

LIMITATIONS

One of the obvious limitations of our study was that it was essentially a pilot study with a small sample size. It might be difficult to generalize the results due to the inadequacy of sample size. Moreover, the results could not demonstrate that level of knowledge acquired with this method was superior to conventional teaching methods. Although our study shows that a third of the respondents agreed that the modules encouraged them toward self-study, we did not actually compare this with the self-learning tendency in the normal conventional teaching methods.

END NOTE

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