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Community Medicine

Effectiveness of Computer-Assisted Instruction in Biostatistics

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ABSTRACT **Background**: Biostatistics teaching as part of the graduate medical programs has become a challenge due shortage of trained faculty, inappropriate teaching-learning methods and insufficient teaching time. Various methods have been think of to overcome this short coming and use of computer assisted instruction modules (CAM) is one such method.

Objectives: It has been attempted to study the effectiveness of CAM for teaching biostatistics in a group of medical students.

Methods: The study was conducted in sixty third year medical students divided two batches, one the test group and the other was the control. Actual knowledge acquisition was evaluated using a post-test score.

Results: Majority of students in test group were comfortable using CAM. The results were compared between two groups, suggesting that the difference was not significant and had comparable effectiveness (P-value of 0.091). Conclusion: The use of computer skill labs and interactive digital modules might increase the effectiveness of teaching of biostatistics.

KEYWORDS : Biostatistics, computer assisted modules (CAM),

Introduction and background

It is evident that the analysis of much of the research in the health sciences depends on advanced statistical 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 in India. This has been faced by several challenges during the past. Shortage of trained faculty, inappropriate teaching-learning methods and insufficient teaching time are the major issues. Various methods have been think of to overcome this short coming. To train more faculty and the increase of the teaching hours are more resource consuming and thus impractical. Instead of this, to develop innovative teaching learning methods will become one cost effective intervention to improve the effectiveness of biostatistics teaching. Using computer assisted instruction modules is one such method adopted in this regard.

The graduate students usually have a strong motivation to use the computer for learning purpose. These student skills and attitudes suggesting us to use the computer based modules to enhance the learning of biostatistics in the medical curriculum. Also the use of computers in teaching eventually allows the student to concentrate on the interpretation of the analysis rather than on arithmetic calculations.

The computer assisted module (CAM) can be introduced in the undergraduate medical curriculum preferably for the year three students posted in the community medicine specialty. Before introducing it for regular teaching sessions, the usefulness and effectiveness of the modules and its acceptance among students has to be evaluated along with a control group taught in the conventional method.

Objectives

To study the effectiveness of computer assisted modules for teaching biostatistics in a group of under graduate medical students.

Methods

The CAM in biostatistics developed by World Health Organization used in this study, has been designed in such a way that the students can learn biostatistics independently using the module when no book or tutor is available. The broad topics covered in this module 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 CAM was tested on third year medical students, 60 in two batches, each posted for 6 weeks in community medicine. The first batch was the control and they were taught 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. Level of knowledge acquired was evaluated using pre and post-tests for the two groups.

Results

The analysis revealed that 53% of the students feel that CAM are a better method than lecture class. But only 33% were comfortable in using the module and 36% felt that it encouraged them towards further in-depth self-learning on the concerned topics. 67% favored modifications in the content of the module, to turn it in to 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 computer assisted modules will enhance its usefulness. The CAM was a good innovative experience for 87% of students (Table 1).

Table 1.Students'Feedback

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
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 equiped 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%

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 significant improvement in the level of knowledge acquired ($p<.001$) 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 medical education with a paradigm shift from the conventional 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.

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.[4] 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.[5]

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.[6] When compared self-learning outcomes using the software and the printed materials, there was 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.[7]

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.[8]

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.[9]

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 CAM for teaching biostatistics is as good as the conventional lectures. There was significant improvement in the level of knowledge acquired as per the scores of the pre and post-tests in both the groups. Majority of students feels that the CAM 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 CAM will enhance its usefulness. The usefulness and effectiveness of CAM can be improved by including short videos, interactive games, short puzzles, online assignments etc. Students wanted to repeat the method of CAM 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 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 its 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 towards self-study, we did not actually compare this with the self-learning tendency in the normal conventional teaching methods.

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