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A study to compare the effectiveness of computer assisted learning (CAL) with that of graphs and card based practical session, on the enhancement and retention of knowledge among undergraduate students of pharmacology

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Abstract
In our study, we evaluated the effectiveness of computer assisted learning (CAL) with that of a practical session based on graphs and card based discussion, on the enhancement as well as retention of knowledge among undergraduate students of Pharmacology. Group 1 was taught the concept relating to the effects of autonomic drugs on blood pressure by a practical session based on graphs and charts while Group 2 was taught the same using the CAL program. Knowledge gain and retention by the two sessions were assessed by comparing the mean scores attained by the groups during the immediate post-test and delayed post-test respectively. Both groups had significantly better scores in the immediate post- test when compared to their respective pre-test scores. However, there was no significant difference between the groups in the immediate post-test scores (29.25vs28.33, $p>0.05$) implying that both sessions were equally effective in enhancing knowledge. In the delayed post-test the mean score of Group 2 was significantly better than Group 1(28.70vs22.15, $p<0.05$) implying that CAL has more effect on the knowledge retention compared to practical class based on graphs and charts. It was concluded that CAL can be an effective teaching aid and should be seen as complimentary to other teaching methods for medical students.

Keywords: CAL, blood pressure, knowledge retention

1. Introduction
Learning pharmacology at undergraduate level involves comprehending the core concepts through lectures, group discussions, tutorials, clinical case studies, e learning and practical sessions. Practical sessions in Pharmacology strengthen the theoretical concepts by demonstrating the effect of drugs on isolated tissues or whole animals [1]. However, due to ethical concerns regarding the use of animals solely for learning purpose, animal experiments in Pharmacology were phased out [2]. This has led to the undergraduate practical sessions in Pharmacology being just an extension of theory lectures, based on graphs and charts based discussions resulting in students being mere passive learners. However, in the recent years, a variety of computing programmes simulating animal experiments have been developed for undergraduate teaching of Pharmacology.

The CAL software consists of simulations of a number of Pharmacology lab experiments that can be used to substitute live demonstrations. They are also equipped with pre-lab and post-lab quizzes, stop and think questions within the steps of each experiment which help students make the connection between the activities and the concepts they demonstrate. Hence CAL offers a student centered approach involving their active learning.[3] However, studies assessing the effectiveness of CAL on the knowledge enhancement and retention are limited. Of the available studies assessing CAL program, most are based on the student feedback regarding CAL. In our study, we conducted an objective assessment of the effectiveness of CAL on the enhancement and retention of knowledge regarding the concepts of Pharmacology.

2. Methodology
The study protocol was approved by the Institutional Ethics Committee and each participant gave informed consent. Second year MBBS class of 80 students were randomized into two groups of 40 students each after they had completed 14hours of theory lectures on drugs acting on autonomic nervous system. A pre-test consisting of 40 single response questions was conducted for both the groups on the same day and time.

In a traditional practical class using animals, the effect of drugs on blood pressure were classically demonstrated on a dog. In our study, for Group 1 (graphs and card), the instructor gave a 20minute lecture describing the instruments, procedure and observations of the experiment to study the effect of drugs on dog blood pressure (BP). It was then followed by an interactive session wherein the instructor provided the students with graphs showing the effect of different drugs on BP. The students were asked to identify the drug which caused the particular effect on BP. They were also provided with cards with a set of questions. The students were given time to find the answers of the questions followed by a group discussion of the answers. The total duration of the session was 2 hours.

For group 2 (CAL), the same instructor gave a brief introduction and demonstration of CAL. We used the Ex pharm software developed by Elsevier for our study. It consists of step by step description of the experiment along with images and a program simulating the effects of drugs on dog BP. The demonstration by the instructor was followed by hands on session for the students wherein they worked in sets of three per computer. The students were asked to run the tutorial mode of the program first wherein the drugs can be chosen (from a list of drugs available) and administered. The effect is displayed in animated sequences for realistic simulation. Tutorial mode also gave the explanation for the observed effects. After studying the effects of different drugs in the tutorial mode, they were asked to perform the examination mode of the software wherein they had to identify the unknown drugs. The software also contained a post simulation quiz containing questions with answers. The total duration of the session was 2 hours.

After the completion of their respective sessions, both the groups were given an immediate post-test consisting of 40 single response questions. Both the groups were given a delayed post- test after 8 weeks. This contained 40 single response questions.

All data collection was done in a blinded manner. The data was analysed using SPSS software package version 19. 0. Parametric data was analysed using t test. Statistical significance was considered at $p< 0.05$.

3. Results

All the students enrolled in the study completed it. There was no significant difference between the groups with respect to the mean scores obtained in the pre-test implying that the groups were comparable at the start of the study. Comparison of the mean scores of the groups in the pre-test is shown in Table 1.

We compared the mean scores obtained in the immediate post-test with the pre-test scores in each group to assess the knowledge enhancement by each of the sessions. The mean scores of both the groups in the immediate post- test were significantly higher than their respective mean scores in the pre-test. This is shown in Tables 2 and 3.

When the mean scores of both groups in the immediate post-test were compared, no statistically significant difference was found between the groups. Comparison of mean scores of both groups in immediate post- test is shown in Table 4. However, when the mean scores of the groups in the delayed post- test were compared in order to assess the knowledge retention, the mean score of Group 2 (CAL) was higher than Group 1(graphs and card) and the difference was statistically significant ($p<0.05$). This comparison is shown in Table 5.

Table 1: Comparison of Pre-test scores of the study groups

Parameter	Group	N	Mean	Standard deviation	t	p value
Pre-test score	Group 1 (graphs and card)	40	19.40	6.42	0.059	0.476
	Group 2 (CAL)	40	19.57	6.26		

Table 2: Comparison of Pre-test score and immediate post test score of Group 1

Parameter	N	Mean	Standard deviation	t	p value
Pre-test score	40	19.40	6.42	17.64	<0.00001
Immediate Post-test score	40	29.25	4.92		

Table 3: Comparison of Pre-test score and immediate post test score of Group 2

Parameter	N	Mean	Standard deviation	t	p value
Pre-test score	40	19.57	6.26	9.27	<0.00001
Immediate Post-test score	40	28.33	5.10		

Table 4: Comparison of Immediate Post-test scores of the study groups

Parameter	Group	N	Mean	Standard deviation	t	p value
Immediate post-test score	Group 1	40	29.25	4.92	1.48	0.0714
	Group 2	40	28.33	5.10		

Table 5: Comparison of Delayed post-test scores of the study groups

Parameter	Group	N	Mean	Standard deviation	t	p value
Delayed post-test score	Group 1	40	22.15	6.35	6.89	<0.0001
	Group 2	40	28.70	3.45		

4. Discussion

Both the groups were comparable at the start of the study as there was no significant difference in their pre-test scores. Both the groups had significantly better scores in the immediate post-test when compared with their respective scores in the pre-test. This implies that both the sessions significantly enhanced the knowledge of students as indicated by the better scores post the sessions. However, inter group comparison of mean scores of immediate post test showed no significant difference between the groups implying that both modalities were equally effective in enhancing the knowledge of the students and the superiority of neither could be ascertained. Similar findings were found in studies by Turner and Clark [6, 7]. However in study done by Luffingham, there

was a significant difference immediately after the study, with CAL group showing a better response [8]. In contrast, Hobson *et al.* in their study reported the practical session to be superior to CAL [9].

In the delayed post-test, the CAL group had significantly better performance than graph and card group. Better scores for CAL group in delayed post-test indicates that CAL has more effect on knowledge retention as compared to graphs and card based practical session. Similar finding was reported by Irvine *et al.* in their study [10]. In contrast to the findings in our study Kasturi *et al.* in their study suggested that simulation does not enhance long term retention of concepts related to autonomic pharmacology when compared to paper based problem solving methods [11]. The finding in our study may be because of the active learning involved in CAL. Self-instructional nature of CAL could have provided highly effective reinforcement of concept resulting in better performance in the delayed post-test.

Limitations of our study include the small sample size and the fact that assessment of knowledge retention beyond 8 weeks could not be done. It is also acknowledged that differences in individual motivation, learning styles and use of pharmacology textbooks, course syllabus, electronic sources as well as participation in informal peer group study are variables beyond the control of the study conditions that can profoundly confound the study outcome and its interpretation.

5. Conclusion

Our study has shown that CAL effectively enhances knowledge and is superior to graph and card based practical session in its effectiveness on the retention of acquired knowledge. Hence CAL can be an effective teaching aid and should be seen as complimentary to other teaching methods for medical students. However further studies are required to assess if its effectiveness on knowledge retention persists over a longer duration of time.

6. References

1. Govindaraja C, Jaiprakash H, Annamalai C, Vedhavathy SS. Computer assisted learning: Perceptions and knowledge skills of undergraduate medical students in a Malaysian medical school. National Journal of Physiology, Pharmacy and Pharmacology. 2011; 1:63-7.
2. Solanki D. Unnecessary and cruel use of animals for medical undergraduate training in India. J Pharmacol Pharmacother. 2010; 1:59.
3. Badyal DK, Desai C. Animal use in pharmacology education and research: the changing scenario. Indian J Pharm. 2014; 46:257-65.
4. Kuruvilla A, Ramalingam S, Bose AC, Shastri GV, Bhuvaneshwari A, Amudha G. Use of computer assisted learning as an adjuvant to practical pharmacology teaching: Advantages and limitations; Indian J Pharm. 2001; 33:272-5.
5. Vadivelan R, Santilna KS, Elango K, Sirisha S. Alternatives to animal experimentation in teaching pharmacology: computer assisted learning techniques in pharmacy curriculum; Indian J Physiol Pharmacol. 2015; 2:70-3.
6. Turner PJ, Weerakony S. An evaluation of a hypertext system for computer assisted learning in orthodontics. Br J Orthod. 1993; 20:145-8.
7. Clark RD, Weerakony S, Rock WP. A hypertext tutorial for teaching cephalometrics. Br J Ortod. 1997; 24:325-8.
8. Luffingham JK. An assessment of computer assisted learning in orthodontics. Br J Orthod. 1984; 11:205-8.
9. Hobson RS, Carter NE, Hall FM, Atkins MJ. A study into the effectiveness of a text based computer assisted learning program in comparison to seminar teachings of orthodontics. Eur J Dent Educ. 1998; 2:154-9.
10. Irvine NR, Moore RN. Computer assisted instruction in mixed dentition analysis. J Dent Educ. 1986; 50:312-5.
11. Kasturi R, Heimburger, Nelson E, Phero J, Millard RW. Does human simulator aided learning improve long term retention of autonomic pharmacology concepts and facts by year II medical students. IAMSE. 2007; 19(3):89-94.