

# Comparison of the Impact of PowerPoint and Chalkboard in Undergraduate Medical Teaching: An Evidence Based Study

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## ABSTRACT

**Objective:** To compare the impact of the PowerPoint multimedia presentation and chalkboard in teaching by assessing the knowledge based on the marks obtained.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Department of Physiology, College of Medicine, King Saud University, Riyadh, Kingdom of Saudi Arabia, from December 2007 - June 2009.

**Methodology:** Three-hundred male medical students were divided into three groups and a selected content-based lecture in physiology was delivered. For one group lecture was delivered using PowerPoint presentation, for second group using chalkboard and for third group the lecture was delivered by using both PowerPoint as well as chalkboard. Single-best Multiple Choice Questions [MCQs] paper was used for assessing the knowledge gained. The same exercise was repeated in another medical science school for the confirmation of validity and reliability of the results.

**Results:** Students who attended the class on both PowerPoint and chalkboard obtained significantly higher score in single best MCQ examination compared to those students who attended the same content based lecture on the PowerPoint or chalkboard alone ( $p = 0.05$ ).

**Conclusion:** The integrated (PowerPoint and chalkboard) method of teaching was found more suitable tool of teaching and learning than PowerPoint or chalkboard alone.

**Key words:** PowerPoint. Chalkboard. Teaching and learning. Teaching methods.

## INTRODUCTION

The applications of computer technology enhances the ability to process the ever-increasing volume of medical knowledge.<sup>1</sup> The multiple resources provided by the Internet offer a new and exciting environment that can improve patient care, education, and research.<sup>2</sup> Over the past decade the utilization of software applications (e.g. PowerPoint) in medical schools have dramatically increased. PowerPoint is said to serve more as a mean of mapping and directing the flow of a classroom discussion on a topic than as a mean of presenting the materials themselves.<sup>3</sup>

Teaching and learning are active processes occurring simultaneously on a continuous basis.<sup>4</sup> Teaching is a mean of facilitating and supporting learning and involves contingent functions.<sup>5</sup> However, learning is the cognitive processes whereby an individual acquires the professional and ethical values, the bio-medical, behavioural and

clinical knowledge, reasoning and psychomotor skills necessary for professional competence.<sup>6</sup> Furthermore, learning is relatively permanent change in the behaviour of the learner.<sup>7,8</sup> This can be demonstrated when learners acquire the ability to express their gained insight, realization, facts and new skills.<sup>9</sup> Both teaching and learning are dependent on myriad contextual factors, including the teacher, the learner, the subject matter, environment(s) and the teaching methods. The responsibility lies on the teacher to ensure that student is given the opportunity to think in the classroom.<sup>10</sup> It has to be acknowledged that attention should be given to the teaching of thinking skills, such as reasoning, creative thinking, and problem solving; as thinking is essential to knowledge and knowledge is essential to thinking.<sup>11</sup> Additionally, teachers should ensure that students are given the opportunity to develop their metacognitive abilities. In teaching and learning, strategies should be developed to use of PowerPoint appropriately in the classroom as a tool rather than as a toy.

The aim of this study was to compare the impact of the PowerPoint multimedia presentation and chalkboard in teaching by assessing the knowledge based on the marks obtained.

## METHODOLOGY

This cross-sectional study was conducted in the Department of Physiology, College of Medicine, King

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Saud University, Riyadh, Kingdom of Saudi Arabia from December 2007 - June 2009. A total of 300 male medical students [First medical sciences school  $n = 234$  and the second medical sciences school  $n = 66$ ] participated in this study. A selected content based lecture in physiology was delivered in two different medical science schools. In each medical science school, students were divided into three groups. In first medical sciences school (Table I) a total number of 234 students were divided into three groups. For one group lecture was delivered by using PowerPoint [ $n = 82$ ]; for second group by using the chalkboard [ $n = 78$ ] and for third group the lecture was delivered by using both PowerPoint as well as chalkboard [ $n = 74$ ]. The same exercise was repeated in other medical science school for the confirmation of validity. In the second medical science school (Table II), a total number of 66 students were divided into three groups. Similarly, for one group lecture was delivered by using PowerPoint [ $n = 24$ ]; for second group by using the chalkboard [ $n = 20$ ] and for third group the same lecture was delivered by using both PowerPoint as well as chalkboard [ $n = 22$ ]. Students with known history of gross anaemia, headache, insomnia, central or peripheral nerve diseases, hearing and vision disorders and those using any medication were excluded from the study. Students were provided a pleasant environment, well arranged classroom seating, classroom temperature was about 20 – 24°C. The time allocated for the lecture in all groups was equal. Immediately after the lecture a single best multiple choice questions (MCQs) paper consisting of 5 questions was distributed and students were asked to attempt all the five MCQs within the required time. Each question carried a single mark.

Multiple-choice question examination consisted of main items with five stems, which tested the cognitive

knowledge in a specific content of physiology. Test items were selected from a large bank of questions developed by faculty members, Department of Physiology. The co-ordinator selected items for the examination according to a blueprint designed to match the expected knowledge of the undergraduate medical students.

The sample was described by using mean  $\pm$  SEM for quantitative variables. The analysis was performed using Statistical Package for Social Sciences (SPSS) version 10.0 program for Windows. Statistical analysis was conducted using one-way analysis of variance (ANOVA) and post-hoc test for multiple comparison was applied. A level of statistical significance was established at a value of  $p < 0.05$ .

## RESULTS

Table I shows the comparison of marks obtained by the students in Medical School-1 who were taught on PowerPoint or chalkboard compared to the students who were taught on both PowerPoint and chalkboard. The mean age of the students were  $19.03 \pm 1.71$  years. Significantly higher marks was obtained by students who were taught on PowerPoint as well as chalkboard ( $3.41 \pm 0.12$ ) compared to those students who were taught either on PowerPoint or on chalkboard alone. However, no significant difference was observed between the marks obtained by the students who were taught on PowerPoint ( $3.07 \pm 0.14$ ) compared to the students who were taught on chalkboard ( $3.10 \pm 0.13$ ) alone.

Table II demonstrates the comparison of marks obtained among students in Medical School-2 who were taught either on PowerPoint or on chalkboard compared to the students who were taught by using both PowerPoint and chalkboard simultaneously. The mean age of the students was ( $19.52 \pm 1.44$  years). Significantly higher

**Table I:** Comparison of marks obtained among students who were taught either on PowerPoint or on chalkboard compared to the students who were taught on both PowerPoint as well as chalkboard [Medical science school-1] ( $n = 234$ ).

Parameters	PowerPoint (mean $\pm$ SEM) ( $n = 82$ )	Chalkboard (mean $\pm$ SEM) ( $n = 78$ )	PowerPoint and chalkboard (mean $\pm$ SEM) ( $n = 74$ )	Significance level
Age (years)	$19.24 \pm 1.71$	$19.06 \pm 1.30$	$19.42 \pm 1.67$	NS
Marks obtained	$3.07 \pm 0.14^*$	$3.10 \pm 0.13^\#$	$3.41 \pm 0.12^{*\#}$	* $p = 0.04$ # $p = 0.05$

NS = Non significant

\*Significance between PowerPoint and PowerPoint and chalk-board since  $p=0.04$

#Significance between chalk-board and PowerPoint and chalk-board since  $p=0.05$

**Table II:** Comparison of marks obtained among students they were taught on PowerPoint, chalkboard compared to the students who were taught on both PowerPoint as well as chalkboard [Medical science school- 2] ( $n = 66$ ).

Parameters	PowerPoint (mean $\pm$ SEM) ( $n = 24$ )	Chalkboard (mean $\pm$ SEM) ( $n = 20$ )	PowerPoint & chalkboard (mean $\pm$ SEM) ( $n = 22$ )	Significance level
Age (years)	$19.07 \pm 1.69$	$19.52 \pm 1.44$	$19.52 \pm 1.44$	NS
Marks obtained	$3.58 \pm 0.16^*$	$3.60 \pm 0.18^\#$	$4.0 \pm 0.12^{*\#}$	* $p = 0.04$ # $p = 0.05$

NS = Non significant

\*Significance between PowerPoint and PowerPoint and chalkboard since  $p=0.04$

#Significance between chalkboard and PowerPoint and chalkboard since  $p=0.05$

marks were obtained by the students who were taught on PowerPoint as well as chalkboard ( $4.0 \pm 0.12$ ) compared to those students who were taught on either PowerPoint or chalkboard alone. However, no significant difference was observed between the marks obtained by the students who were taught on PowerPoint ( $3.58 \pm 0.16$ ) compared to the students who were taught on chalkboard ( $3.60 \pm 0.18$ ).

## DISCUSSION

The quality of the learning experience and outcomes requires a special concern not only with the methods of teaching but also with the ways in which the student uses his/her cognitive abilities. The conceptual teaching should be capable of eliciting deep cognitive processing for an appropriate development of ethical and intellectual development. There is also a need to consider teaching and learning in an integrated manner,<sup>12</sup> along with student counselling and development of higher-order thinking skills. The development of thinking can only come about at the cost of reducing the amount of traditional contents<sup>10</sup> that includes the use of only chalkboard and memorization of the contents. The teacher's role is not just to deliver information but also to scaffold and to respond to students' learning efforts. Similarly, the students' role is not just to copy new information, but also to actively make sense and construct meaning.<sup>13</sup> The most important factor in learning is the baseline knowledge of students and new knowledge is constructed by building or enhancing concepts on existing knowledge. The activation of existing knowledge is an obvious starting point in any workable model for teaching. The schema activation, schema construction, and schema refinement model for teaching, coupled with the encouragement of the students to engage in deeper processing and thinking, give credible and robust basis for teaching and present the information in a structured and organized way.

It is also the responsibility of the teacher to facilitate learning, encourage thinking and try to relate what is already known. It would be more productive if the teacher emphasizes the significance of the knowledge gained in future / practical life, so that student become eager to know and learn. The student must be given an opportunity to apply acquired knowledge in various activities such as analysis, synthesis, evaluation and problem-solving. There should also be interaction between students and exchange of views need to be fostered by the teacher so that conflicting views can be considered, discussed and resolved.

Teaching with integrated tools (PowerPoint and chalkboard) facilitate the students and involve in "schema refinement" as the teacher reviews what has been covered and emphasize the key points made. One of the most useful activities for the student is to make a summary in his/her own words of the main thrust of the

session and to annotate this in relation to previous learning and possible future applications.

There is no doubt that learning is better when the learner is active rather than passive. Appropriate learning should be meaningful, achieved on a wide range of stimuli, frequent practice in varied contexts and group discussion is also necessary for effective learning. Moreover, learning is more likely to be effective and efficient if learners are informed as to how well they are doing. Teaching with PowerPoint provides better concepts and this is more elaborated when the teacher highlights important contents of the topic on the board. In the present study, it was observed that when contents such as figures and flow charts were discussed on PowerPoint and then elaborated on chalkboard, the students were more active and got a time to ask the questions compared to showing slides on the PowerPoint or drawing simple slides on the board only. The integrated teaching with PowerPoint and chalkboard keeps the students engaged and motivated. Their attention remains focused on the subject matter and that ultimately leads to better absorption of the core knowledge of the contents.

PowerPoint presentation is an essential instrument of health professionals in teaching. It offers a tremendous number of options for personalizing slides. Having choices of font, color scheme, display options, sound, and graphics providing an opportunity to enhance a presentation in different ways. However, it should be kept in mind that inappropriate use of PowerPoint features can substantially degrade the quality of a presentation.<sup>14</sup> In medical schools, it has also been seen that most of the physicians / teaching faculty do not pay adequate attention to appropriate preparation of PowerPoint due to their busy schedule and assign PowerPoint slide making to their secretarial staff. In such scenario, teaching faculty can neither deliver the lectures adequately, nor can they stimulate the students at active learning standards. A common fault of PowerPoint presentations is the use of slides with too many lines per slide, too many words per line, lines that extend too far inferiorly on the slide, spelling errors, distracting animation effects, too many graphs, and poor colour scheme.<sup>15</sup> In such situation neither the lecturer will be revealing nor will the learner be learning adequately. David and James reported that PowerPoint serves more as a mean of mapping and directing the flow of a classroom discussion on a topic than as a means of presenting the materials themselves.<sup>16</sup> In this study, it was observed that the delivery of the knowledge with PowerPoint only was suboptimal, and students got lower score than the integrated tool of teaching (PowerPoint and chalkboard).

Teaching with chalkboard engages the learners actively and the learners always become attentive to that what the teacher is writing and providing knowledge on the

board. In this traditional method, the teacher can easily engage the learners actively because students think on each written or discussed point on the board. However, there are few limitations of this tool. The teacher may avoid writing or drawing a figure or flow chart on the board. In medical teaching support of illustrations is very important to develop a concept of that organ/structure/system. Therefore, the students may face difficulty to understand the ideas/concept of the content on the chalkboard. Considering all these facts both the tools of teaching have some strength and weaknesses.

According to the American Educational Research Association, "validity refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from test scores".<sup>17</sup> Validity also refers to the extent to which a measurement actually measures what is intended to be measured. Validity is the most important characteristic of any assessment tool.<sup>18</sup> In this study, the same lecture was delivered in two different medical science schools to confirm the validity of these results.

In the present study, MCQs were designed to measure the knowledge of physiological facts; all the questions were relevant and related to the specific contents discussed in the lecture. The content validity was observed through expert opinion that all the questions were related to the contents of the topic and adequately reflected the key learning outcomes. However, for the face validity students were asked i.e., do the items in MCQs appear fair and appropriate according to the content of topic delivered in the class room.<sup>19</sup> At the end of assessment student's comments were taken on the fairness of the assessment exercise and most of the students commented that all the items appeared fair and appropriate and they were very pleased about the entire exercise.

### CONCLUSION

The results of the present study suggest that both the tools of teaching (PowerPoint or chalkboard) have some strengths and limitations. Therefore, integrated (PowerPoint and chalkboard) method of teaching is more suitable tool of teaching and learning at undergraduate medical schools than PowerPoint or chalkboard alone.

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