Available online at http://www.mecs-press.net/ijeme

Advantages and Disadvantages of PowerPoint in Lectures to Science Students

[a]Ding Xingeng, [b]Liu Jianxiang

[a] Department of Materials Science and Engineering Zhejiang University Hangzhou, China
[b] School of Medicine and Life Sciences Zhejiang University City College Hangzhou, China

Abstract

PowerPoint is now widely used in lectures to science students in most colleges of China. We summarize its advantages as producing better visual effects, high efficiency in information transfer, precise and systemic knowledge structure. Disadvantages of PowerPoint may be induced by irrelevant information in slides, neglect of interaction with students, uncontrolled speed in presenting or too strict order of slides. Strategies to avoid these disadvantages are proposed.

Index Terms: PowerPoint; advantages; disadvantages; science students

1. Introduction

PowerPoint is now one of the most widely applied software in classroom teaching. PowerPoint presentation has many advantages over traditional "chalk-and-talk" lecture. However, PowerPoint is not almighty. An early study compared classes taught with and without PowerPoint materials, and showed no significant change in student performance with PowerPoint though most students prefer PowerPoint to chalkboard [1]. Another study reported that, PowerPoint may have created a generally favorable impression of the class and the professor, but not significantly affecting grades [2]. If inappropriately used, PowerPoint would decrease the effect of the lecture. It is thus important to realize advantages and disadvantages of PowerPoint, as well as strategies to avoid its disadvantages.

2. Advantages of PowerPoint

2.1. Producing Better Visual Effects and Deeper Impression

The contents of a science lecture is often abstract, sometime they are hardly to explain using chalkboard. However, by presenting PowerPoint slides inserted with pictures, flow charts, schematics, animations, even video clips, the lecture may become vivid and attractive to students. For example, in chemistry, the shift between

Corresponding author:
E-mail address: [a]msedxg@zju.edu.cn, [b]l iujx@zucc.edu.cn

two conformations of a molecular is hard to explain using chalk writing, but it could be easily demonstrated by two figures in PowerPoint. For another example, when explaining physicochemical process "sintering", a series of pictures of scanning electronic microscope could be displayed to show the process that granules adsorption, adhesion and the crystal formation. Students would thus easily understand this special term, and they would be impressed with the mass transfer and heat transfer process.

Several studies supported the hypothesis that graphics and animations improve students' recall [3,4]. Also, PowerPoint lecture may benefit recall, or perhaps recognition, from memory [5]. With the help of advanced projector with high contrast and resolution, a better effect of PowerPoint presentation could be obtained.

2.2. Speeding up the Information Transfer

In a PowerPoint presentation, the teacher can deliver more information than by traditional lecture. The amount of information transferred in a traditional lecture is often limited by the writing speed of the instructor on chalkboard. But in a PowerPoint presentation, all outlines were typed previously in slides. Especially, when instruction of science courses need to present large amount of data, using PowerPoint could significantly increase the efficacy of a lecture.

Compared with chalkboard-writing in traditional lecture, a PowerPoint file can be easily copied, maintained, transferred and printed. To students, the file maybe available on-web before or after the class, and may thus be previewed or reviewed. This may be the most appreciated feature of PowerPoint. When combining PowerPoint with web, the timing of PowerPoint availability to students is important. If PowerPoint file is available before class, students may feel responsible for knowing how to use slides for taking notes, and they may attend and participate in the lecture more easily [6]. On the other hand, PowerPoint presentation saves time for students with learning differences that require more time to take notes, because they may download PowerPoint files from web and obtain organized notes or handouts and accurately drawn graphs [7]. Therefore, PowerPoint may enhance the performance of students at class.

2.3. More Precise and More Systematic

A well-prepared PowerPoint may present students with more precise contents of science knowledge. Before presentation, by editing or reviewing the PowerPoint file, the teacher has enough time to check term spelling, expression of a conception or a theory, logicality of formula derivation, as well as the precision of numbers and data, etc. Therefore the verbal expression in lecture would be more accurate and may be mistake-free. To students, this is essential for correct and accurate comprehension of the science knowledge. After class, by collecting feedback from the students, the instructor would easily optimize PowerPoint slides to fit the students by editing slides.

On the other hand, PowerPoint slides may be systemically organized. The clear outline could be helpful for students to construct correct knowledge in mind.

3. Disadvantages

In a questionnaire survey conducted on students in nurse major in a college of China, 28.3% of participants think the class using PowerPoint is not helpful for their learning. In another question, 48.3% of participants think PowerPoint is not helpful for learning. Most of participants (81.7%) prefer a blending of PowerPoint presentation with "chalk-and-talk" lecture. The reasons given by participants are listed in Table 1.

TABLE I.   REASONS FOR NOT PREFERRING POWERPOINT

Order	Reasons	Ratio
1	Cannot concentrate, easy to feel tired	29.2%
2	Dull, not interesting	25%
3	Monotonous, key points not stressed	20.8%
4	Too much information and too fast in presenting	16.7%
5	Lack logicality	8.3%

From the list, we noticed that the negative opinions on PowerPoint were brought by the forms in presentation as well as by contents of PowerPoint. We summarized the disadvantages of PowerPoint as at least four points as follow.

3. 1 Irrelevant information may be harmful

There are often some abstract or even abstruse contents in a science lecture. If they were displayed in slides by merely bullet points, the interest of students would be reduced. In order to attract students' attention, some instructor may add some decorative but irrelevant figures or animations into a slide. Though students might be more interested in the image-rich slides than bullet points [7], unrelated graphics are not helpful for learning [8].

A study using eye-tracking technology confirmed that students devote more attention to highly relevant photographs [9]. Another study also found that students spent more time viewing task-relevant information and less time viewing task-irrelevant information after instruction [10]. Irrelevant pictures may even be harmful to comprehension of students [11]. It was also concluded that, as the interestingness of details is increased, student understanding decreases [12]. This is in consistence with a cognitive theory about multimedia learning, in which highly interesting details sap processing capacity away from deeper cognitive processing of the core material during learning [13].

Moreover, a recent study also demonstrated that presence of task-irrelevant information impaired performance, therefore an effective graphical displays should not display more information than is required for the task at hand [10].

3. 2 Neglect of interaction with students may make a lecture a monologue

Though the aid of a PowerPoint makes the instructor more confident, usually the instructor's eyes will stay more on the screen than on the face of students. The lecture may thus lack eys-contacts between teacher and students. This may zoom out the distance between them. A lecture without eye-contact, is similar to a "virtual-lecture" in some aspact.

If the contents of a lecture is not well-arranged, or if the instuctor is not familiar with the contents, he may tend to omit asking questions or discussion with students. We noticed that many science students are relatively shy. In such situations they would move their eyes from screen to textbook, thus the instruction would become a monologue of the teacher.

On the contrary, one of the advantages of traditional lecture is that, with enough interaction, students may easily catch the thought of instructor. This merit of chalk-and-talk lecture may be the main reason for that some professors are always welcomed even though they may never use PowerPoint in their presentation.

3. 3 The high speed may reduce participation of students

If there are too many lines in a slide, when projecting, students may soon feel tired or disappointed when they find it is difficult to follow the instructor. If the instructor pays no attention to reflect from the students, he may

easily accelerate the speed of presentation. Sometimes, even though he may aware of the feedback from students, in order to finish the lecture content, he may still go on fast. When the speed of the instruction continuously exceeds the comprehensive speed of students, the two parts of a class may separate. It may lead to the failure of the lecture.

3. 4 Too strict order of slides may limit the extemporaneous performance of instructor

Compared with traditional chalkboard lecture, PowerPoint would more easily limit the though of the instructor. Therefore there may be a lack of extemporaneous performance of instructor.

In a PowerPoint, the order of slides is previously fixed. If the instructor could not control the rhythm while presenting slides, he might be easily controlled by the PowerPoint. Therefore the instructor may need to adjust the progress by extemporaneous pause, questions, or even change the order of slides temporarily if necessary.

4. Strategies to avoid disadvantages

4. 1 Use PowerPoint as an assistant tool in education

A principle should be hold during preparing and presenting PowerPoint. That is, PowerPoint is but a tool of a lecture. Chalkboard writing, as another useful tool may play unique role. For example, when comparing two conceptions or processes, or summarizing a table, the instructor may interact with students, leading students step by step with questions and chalkboard writing. The effect may be much better than the simple instruction with a PowerPoint.

PowerPoint could be useful in specific instruction where dynamic models, animation, and variation of color may definitively help in the better illustration of the key concepts [5]. If students are expected to retain complex graphics, animation, and figures, PowerPoint presentations may have an advantage over traditional lecture. However, if students are expected to retain information and/or concepts that are best conveyed through dialogue or verbal explanation, traditional presentations appear to be best [14].

4. 2 Design a PowerPoint properly and delicately

Many tips for a good PowerPoint had been introduced. For example, only place essential points on the outline slide; avoid using long sentences, use key words and phrases instead; use proper font, size, color and background; avoid using animation that may cause distracting; use graphs rather than charts and data, etc [15,16]. However, while applying, all above tips should be considered again to make sure that they are suitable for the contents of the lecture, and also for students in certain major. For instance, graphics are not necessary for simple declarative information, but may help with more difficult, complex, or abstract concepts presented through lecture [8].

4. 3 Communicate with students in applying PowerPoint

In showing a PowerPoint, the instructor should be very cautious about the feedback from the students. One of the characteristics of college education is face-to-face communication [16]. On which more attention should be paid when presenting PowerPoint to science students, because they may communicate less efficiently and less effectively than students of social sciences. PowerPoint may become a barrier between teacher and students.

4. 4 Explore new ways to use PowerPoint

It is indicated that PowerPoint, internet and video have different influence on students' perceptions of learning and motivation. An instructor may use a different mix of technologies in the classroom and use them creatively in order to promote the learning of students and to satisfy students' learning needs and objectives [17]. By onscreen synchrony of PowerPoint slides and recorded voice, so-called "e-lecture" may be delivered on web and serve as a useful alternation of traditional lecture, either alone or combined with other methods [18].

5. Summary

PowerPoint is a powerful teaching tool. Both its advantages and disadvantages should be recognized. The employment of PowerPoint should be based on the hypothesis that the instructor is very familiar with the lecture contents and the audience. Only on the basis of thoroughly understanding of backgrounds and needs of students, by flexibly blending it with other effective techniques, the power of PowerPoint could be elaborated.

References

[1] L. Daniels, "Introducing technology in the classroom: PowerPoint as a first step," J. Comput. High Educ., vol. 10, pp. 42-56, March 1999.

[2] J. M. Apperson, E. L. Laws and J. A. Scepansky, "An assessment of student preferences for PowerPoint presentation structure in undergraduate courses," Comput. Educ., vol. 50, pp. 148–153, January 2008.

[3] R. B. Lowry, "Electronic presentation of lectures—effect upon student performance," U. Chem. Ed., vol. 3, pp. 18–21, April 1999.

[4] L. J. ChanLin, "Attributes of animation for learning scientific knowledge," J. Instr. Psychol., vol. 27, pp. 228–238, December 2000.

[5] A. Szabo and N. Hastings, "Using IT in the undergraduate classroom: should we replace the chalkboard with PowerPoint?" Comput. Educ., vol. 35, pp. 175-187, November 2000.

[6] K. A. Babb and C. Ross, "The timing of online lecture slide availability and its effect on attendance, participation, and exam performance," Comput. Educ., vol. 52, pp. 868–881, May 2009.

[7] J. M. Tangen, M. D. Constable, E. Durrant, C. Teeter, B. R. Beston, and J. A. Kim, "The role of interest and images in slideware presentations," Comput. Educ., in press.

[8] R. A. Bartsch and K. M. Cobern, "Effectiveness of PowerPoint presentations in lectures," Comput. Educ., vol. 41, pp. 77–86, August 2003.

[9] D. A. Slykhuis, E. N. Wiebe, and L. A. Annetta, "Eye-tracking students' attention to PowerPoint photographs in a science education setting," J. Sci. Educ. Tech., vol. 14, pp. 509-520, December 2005.

[10] M. Canham and M. Hegarty. "Effects of knowledge and display design on comprehension of complex graphics," Learn. Instr., vol. 20, pp.155-166, April 2010.

[11] R. Moreno and R. E. Mayer, "A coherence effect in multimedia learning: the case for minimizing irrelevant sounds in the design of multimedia instructional messages," J. Educ. Psychol., vol. 92, pp. 117–125, March 2000.

[12] R. E. Mayer, E. Griffith, I. T. N. Jurkowitz, and D. Rothman, "Increased Interestingness of Extraneous Details in a Multimedia Science Presentation Leads to Decreased Learning," J Exp. Psychol. Appl., vol. 14, pp. 329-339, December 2008.

[13] R. E. Mayer, Multimedia Learning. Camdridge, UK: Cambridge University Press, 2001.

[14] A. Savoy, R. W. Proctor, and G. Salvendy, "Information retention from PowerPoint and traditional lectures," Comput. Educ., vol. 52, pp. 858–867, November 2009.

[15] J. Holzl, "Twelve tips for effective PowerPoint presentations for the technologically challenged," Med. Teach., vol. 19, pp. 175-179, January 1997.

[16] D. D. Howell, "Four key keys to powerful presentations in PowerPoint: take your presentations to the next level," Tech. Trends, vol. 52, pp. 44-46, November/December 2008.

[17] T. L. P. Tang and M. J. Austin, "Students' perceptions of teaching technologies, application of technologies, and academic performance," Comput. Educ., vol. 53, pp. 1241-1255, December 2009.

[18] J. E. Stephenson, C. Brown, and D. K. Griffin, "Electronic delivery of lectures in the university environment: An empirical comparison of three delivery styles," Comput. Educ., vol. 50, pp. 640–651, April 2008.