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Aidan O'Dwyer

Dublin Institute of Technology, aidan.odwyer@dit.ie

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RESPONSES OF ENGINEERING STUDENTS TO LECTURES USING POWERPOINT

Aidan O'Dwyer,
School of Electrical Engineering Systems, DIT Kevin St., Dublin 8.
E-mail: aidan.odwyer@dit.ie

ABSTRACT

This contribution reports on, reflects on and evaluates engineering students responses to the use of PowerPoint in a lecture environment, compared to a more traditional lecturing approach. The contribution concludes that, on average, students value PowerPoint based lectures both as a means of better understanding the material and for the mediums structural and organisational advantages. Students also strongly favour the PowerPoint lectures being available on-line and that a paper copy of the PowerPoint presentation be distributed at the lecture.

INTRODUCTION

There is increasing emphasis placed on the electronic delivery of lecture material, typically by means of PowerPoint presentations. This is driven by investment in the required IT equipment (data projectors and computers), the use of online environments (such as WebCT) and the reduction, in engineering, in class contact hours. Despite these driving factors, the use of PowerPoint in lectures has not been analysed in detail in the engineering education literature. Some authors in this literature analyse the changes in standardised test scores as a result of moving to a PowerPoint delivery mechanism (e.g. [1]); other authors are content with providing tips for effective PowerPoint presentations (e.g. [2]-[4]), avoiding 'death by PowerPoint' ([2], [3]). In particular, surveys of engineering student perceptions of the advantages and disadvantages of a lecturing approach that uses PowerPoint for a substantial part of the lecture material, compared to a more traditional lecturing approach using a blackboard or an overhead projector, are absent. There exists some analysis in the wider educational literature of the perceptions of (typically) humanities students obtained using structured surveys ([5]-[8]).

In this contribution, the responses of three engineering student cohorts at Dublin Institute of Technology to the use of PowerPoint (and associated on-line material on WebCT), are assessed using a questionnaire influenced by previous work ([5]-[8]). The questionnaire was distributed at the end of the semester in all cases. The questionnaire, provided in Appendix 1, uses a 5-point Likert scale, with 1 corresponding to '*strongly disagree*' and 5 corresponding to '*strongly agree*'. Following the lead of [5], the questionnaire is constructed with alternating positive and negative questions to avoid directional bias. For example, in the first question students were asked to indicate whether PowerPoint lectures are more attention capturing than traditional lectures (positive direction). Then, in the second question, they were asked to indicate whether PowerPoint lectures are *less* interesting than traditional lectures (negative direction). The negative items are reversed for scoring.

The three engineering student groups surveyed were a Level 7, Year 1 group in Electrical Engineering studying basic electrical engineering (labelled D0), a Level 8, Year 4 group in Electrical Engineering studying process control (labelled D4) and a Level 9 group in Engineering studying process control (labelled D9). In all cases, students were provided with a paper copy of the presentation prior to the material being covered, and the presentation itself was also previously placed on-line (on WebCT). Approximately 65% of the lecture time of the Level 7

group and 75% of the lecture time of the Level 8 and 9 groups were devoted to lecturing through PowerPoint.

STUDENT FEEDBACK FROM THE STRUCTURED QUESTIONS

The mean values of the responses to the survey questions were compared (between the student cohorts); this data is provided in Tables 1-3. In addition, a weighted average of all responses, obtained from nineteen D0 responses, twelve D2 responses and five D9 responses, equivalent to 48% of the total student cohort, was determined, and is labelled WA in Tables 1-3. For ease of analysis, student responses are ranked according to this weighted average figure.

Table 1: Ranking of WA student responses greater than or equal to 3.5

	D0	D2	D9	WA
I like that a paper copy is also available of the PowerPoint slides	4.4	4.7	4.6	4.5
I like that the PowerPoint slides are available for viewing on WebCT	4.4	4.7	4.6	4.5
I generally find visual elements (e.g. pictures/charts/graphics) helpful in the PowerPoint presentations	4.3	4.5	4.4	4.4
I find PowerPoint based lecture notes easier to understand	4.4	4.0	4.0	4.2
I find that PowerPoint based lectures are better structured and prepared	4.1	4.3	3.6	4.1
With PowerPoint based lectures, I find that my notes are more organised	4.1	4.4	3.0	4.1
I prefer it when important definitions and terms are completely written out on the PowerPoint slides	4.2	3.8	4.4	4.1
I find that PowerPoint based lectures are easier to follow	4.0	4.0	3.8	4.0
I find that PowerPoint based lectures means that the lecturer stays more focused on the lecture material (i.e. he did not skip around or go on tangents)	3.9	4.1	3.8	4.0
I find it helpful for the lecturer to use the PowerPoint slides as a basis for the lecture, adding examples and elaborating beyond the slides on the key points	4.0	4.0	4.0	4.0
I find that PowerPoint based lectures better emphasise the important points	3.8	3.9	4.0	3.9
I am satisfied with the print size on the paper copy of the slides, as I know that the full sized information is available on WebCT	3.5	4.2	4.4	3.9
I generally prefer slides that provide the full text of the lecture material (i.e. everything that the lecturer wants me to know is completely written out on the slide)	3.9	3.9	4.0	3.9
I find it helpful for the lecturer to read the PowerPoint slides as they are presented	4.3	3.5	3.6	3.9
I wish PowerPoint slides were used for lecturing in all subjects	4.1	3.6	3.8	3.9
I find that PowerPoint based lectures are visually more clear	3.9	4.0	3.0	3.8
I find that PowerPoint based lectures allows the lecturer to better use the lecture time to balance lecture and discussion (or problem solving)	3.8	3.7	4.2	3.8
I find I use a textbook less when the lecturer uses PowerPoint slides	3.8	3.6	4.2	3.8
I find that PowerPoint based lectures are more interesting	3.7	3.6	3.8	3.7
I find that PowerPoint based lectures mean that I learn more in the lectures	3.7	3.8	3.6	3.7
It was easy for me to access WebCT	3.4	4.0	4.4	3.7
I find that PowerPoint based lectures mean that there is more motivation for me to come to lectures	3.8	3.1	3.8	3.6
I find that PowerPoint based lectures are more attention capturing	3.7	3.2	3.6	3.5

This table corresponds to student agreement or strong agreement with the relevant statements. There is broad agreement, with some difference in emphasis, between students on the three programmes surveyed. Clearly, all students value PowerPoint based lectures both as a means of better understanding the material and for the mediums structural and organisational advantages. On average, students suggest that PowerPoint based lectures are more interesting and facilitate

greater learning (than a more traditional approach). These advantages also emerge from the students' unscripted comments (see next section). It is also clear that students favour the presentations being available on-line, with a paper copy of the material being available during the lecture. The following differences in emphasis are evident:

- Level 9 students are less likely to report that their notes are more organised when PowerPoint is used, perhaps because these postgraduate students have developed organisational skills to a higher extent than the undergraduate students surveyed.
- Level 7 and Level 8 students favour visual elements in PowerPoint presentations, reflecting the strongly visual learning style of this cohort of students.
- Level 7 students are less confident and engaged with WebCT, perhaps due to inexperience.

Table 2: Ranking of student responses between 2.5 and 3.5

	D0	D2	D9	WA
I find that PowerPoint based lectures maintain my focus and interest in the lecture material for a longer time	3.7	3.0	3.4	3.4
I find I enjoyed the class more when PowerPoint lectures are used	3.5	3.3	3.2	3.4
I find that PowerPoint based lectures mean that taking notes is easier	3.4	2.8	3.4	3.2
I would prefer if the information is revealed line by line on the slide, rather than if the total information on the slide is given all at once	3.3	2.6	4.0	3.2
I would like the lecturer to use a consistent colour scheme in the PowerPoint slides within the same lecture	3.2	3.0	3.5	3.2
When I have a copy of the presentation beforehand, I find it easier for my mind to wander since I have already seen the material	3.1	3.4	3.4	3.2
I prefer slides that contain pictures, charts or graphs only	3.3	2.3	3.4	3.0
I feel that the use of PowerPoint slides inhibits discussion in the lecture	2.9	2.8	3.0	2.9
I would like the lecturer to vary the size and shape of the text used in the PowerPoint slides	3.3	2.4	2.5	2.9
I feel the lecturer should only give an outline of the lecture on the PowerPoint slides, as I would learn more in the lecture if I had to write some of the material	2.7	3.3	3.0	2.9
I find it helpful if each slide is revealed all at once, even if it is ahead of the lecture	2.8	2.8	2.6	2.8
I like it if the lecturer uses electronic sounds that go along with the pictures or concepts that are being presented	2.8	2.3	3.0	2.7
When I have a copy of the presentation, I am less likely to attend class since I already have the material	2.7	3.0	1.6	2.6
I find it boring when the lecturer says the same things the PowerPoint slides say	2.2	2.8	3.2	2.5

This table corresponds to students being unsure about the relevant statements. Again, there is broad agreement, with some difference in emphasis, between students on the three programmes surveyed. It is clear that students, on average, are not exercised by style issues (such as varying the size and shape of the text used or the use of electronic sounds).

Table 3: Ranking of student responses below 2.5

	D0	D2	D9	WA
With PowerPoint based lectures, I felt worse when I missed the lecture compared to lectures where a blackboard or overhead projector are used	2.4	2.1	2.4	2.3
I wish the lecturer would spend less time using PowerPoint slides	1.9	2.5	2.2	2.1
I feel that there is no need for the lecturer to supply a paper copy of the PowerPoint slides, as they are available on WebCT	1.4	1.4	1.6	1.4

This table corresponds to students disagreeing with the relevant statements. Clearly, students strongly desire a paper copy of the PowerPoint slides, perhaps because additional notes can be added during the lecture (in an active learning mode). Interestingly, the previous finding that students, on average, report somewhat greater motivation to attend the PowerPoint based lectures is contradicted by the finding that students, on average, did not feel worse when they missed a PowerPoint based lecture compared to when a more traditional lecture was missed. It is interesting that the general, unscripted comments from some students also reveal some uncertainty and dissatisfaction with a predominately PowerPoint based lecturing approach (see next section).

UNSCRIPTED STUDENT FEEDBACK

Table 4 summarises student comments about preferences for PowerPoint based or traditional lectures (*n* = number of students making the relevant comments).

Table 4: Summary of student feedback – unscripted comments about preferences for PowerPoint based or traditional lectures

I like PowerPoint based lectures better because	*n*
The time is spent understanding the material instead of writing down notes	8
Lectures are clearer and more focused	5
Lectures are easier to read and understand	4
Lectures can be obtained from WebCT, even if a class is missed	3
Lecture notes are well structured and ordered	2
Lectures keep the attention; nothing is missed	2
It is easier to follow the material even if I am absent from the class	1
I like traditional lectures better because	
Writing down the material keeps one more alert	2
I find it easier to study from notes that I have written myself	2
The blackboard is useful to summarise important points	2
It is easier to follow each step in a numerical example	1
After a time, the light from the data projector hurts my eyes	1
I gain more knowledge from PowerPoint based lectures because	
Lectures are better structured and easier to follow	4
I can add my own notes to the PowerPoint handout	3
Pictures and diagrams on PowerPoint slides are good for remembering material	2
Reading and listening simultaneously means all important points are understood	2
Less time is spent on writing notes, giving more time to understand the material	2
It is easy to focus on colourful well-laid out slides (particularly with diagrams)	2
I can store the lectures (from WebCT) on my own computer	1
Sometimes a lecturers handwriting on a blackboard can be hard to read	1
I gain more knowledge from traditional lectures because	
Writing notes makes one listen carefully so nothing is missed	3
Writing notes from the blackboard helps me memorise important points	1
I learn more by doing, rather than just reading notes	1

As before, students clearly value the mediums organisational advantages. Some students find that writing lecture notes aids concentration and study; such notes can, of course, be added by students to the PowerPoint document.

Generally, other unscripted student comments about the PowerPoint lectures gathered by the questionnaire are positive (e.g. PowerPoint is a clear way to present scientific material; I find

that the classes are more visually stimulating and interesting with the use of PowerPoint and I feel better prepared for the exam; the PowerPoint presentation handouts contains most of the material, making the taking of extra notes easy), with some interesting suggestions (e.g. try to use PowerPoint for half the lecture and use the whiteboard more; perhaps some PowerPoint slides could be left blank and the explanation given in the lectures; sometimes the student is passive in the class and more active learning is desirable); such suggestions are echoed by [4], for example, in which it is recommended that PowerPoint be used for a maximum of 25% of lecture time.

CONCLUSIONS AND FURTHER WORK

On average, students value PowerPoint based lectures both as a means of better understanding the material and for the medium's structural and organisational advantages. Students also strongly favour the PowerPoint lectures being available online and that a paper copy of the PowerPoint presentation be distributed at the lecture. In particular, visual elements are favoured in the presentations, reflecting the strongly visual learning style of engineering students. Such advantages are also reported by [5], for example, who conclude that a majority of (humanities) students believe that PowerPoint based lecturing is more attention capturing, interesting, visually clear and is better at emphasising important topics than the traditional method of lecturing. These authors suggest that these advantages reflect the flexible features of PowerPoint, the better structuring and preparing of PowerPoint lectures (at least in these studies) and perhaps the novelty of the experience (which, if true, would mean that the advantages of the method could be expected to fade with time).

The benefits for student learning are the most important issue in assessing electronic lecturing, according to [5]. Though the majority of students felt that PowerPoint lectures were beneficial for their learning, it would be interesting, in further work, to compare examination and other assessment results of students exposed to both teaching styles, though other variables would have to be considered (e.g. the academic ability of the students, changes in the examination paper).

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APPENDIX 1: STUDENT QUESTIONNAIRE

The purpose of this questionnaire is to obtain views on the lecture experience in the module. ***Thank you for your assistance.***

You are requested to assign a number between 1 and 5 in answer to a series of statements below, with

5 – strongly agree
4 – agree
3 – unsure
2 – disagree
1 – strongly disagree

Thinking about lectures delivered using PowerPoint slides compared to lectures delivered by writing on the blackboard or using overhead projector slides:	**Please tick appropriate box**				
	1 - strongly disagree	2 – disagree	3 – unsure	4 – agree	5 – strongly agree
I find that PowerPoint based lectures are more attention capturing					
I find that PowerPoint based lectures are less interesting					
I find that PowerPoint based lectures are easier to follow					
I find that PowerPoint based lectures are visually less clear					
I find that PowerPoint based lectures better emphasise the important points					
I find that PowerPoint based lectures mean that taking notes is harder					
I find that PowerPoint based lectures maintain my focus and interest in the lecture material for a longer time					
I find that PowerPoint based lectures mean that there is less motivation for me to come to lectures					
I find that PowerPoint based lectures are better structured and prepared					
I find that PowerPoint based lectures mean that I learn less in the lectures					
I find that PowerPoint based lectures means that the lecturer stays more focused on the lecture material (i.e. he did not skip around or go on tangents)					
I find PowerPoint based lecture notes harder to understand					
I find that PowerPoint based lectures allows the lecturer to better use the lecture time to balance lecture and discussion (or problem solving)					
I find I use a textbook less when the lecturer uses PowerPoint slides					
With PowerPoint based lectures, I felt worse when I missed the lecture compared to lectures where a blackboard or overhead projector are used					
I find I enjoyed the class more when PowerPoint lectures are used					
With PowerPoint based lectures, I find that my notes are more organised					

I like (a) PowerPoint based lectures or (b) traditional lectures better because

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I gain more knowledge from (a) PowerPoint based lectures or (b) traditional lectures because

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Thinking about the PowerPoint lectures in this subject: **Please tick appropriate box**

	1 - strongly disagree	2 – disagree	3 – unsure	4 – agree	5 – strongly agree
I find it helpful for the lecturer to use the PowerPoint slides as a basis for the lecture, adding examples and elaborating beyond the slides on the key points					
I generally find visual elements (e.g. pictures/charts/graphics) helpful in the PowerPoint presentations					
I prefer it when important definitions and terms are completely written out on the PowerPoint slides					
I like that a paper copy is also available of the PowerPoint slides					
I like that the PowerPoint slides are available for viewing on WebCT					
I am satisfied with the print size on the paper copy of the slides, as I know that the full sized information is available on WebCT					
It was easy for me to access WebCT					
I generally prefer slides that provide the full text of the lecture material (i.e. everything that the lecturer wants me to know is completely written out on the slide)					
I find it helpful for the lecturer to read the PowerPoint slides as they are presented					
I would prefer if the information is revealed line by line on the slide, rather than if the total information on the slide is given all at once					
I like it if the lecturer uses electronic sounds that go along with the pictures or concepts that are being presented					
I feel that the use of PowerPoint slides inhibits discussion in the lecture					

[please turn over]

	1 - strongly disagree	2 – disagree	3 – unsure	4 – agree	5 – strongly agree
I would like the lecturer to vary the size and shape of the text used in the PowerPoint slides					
I wish PowerPoint slides were used for lecturing in all subjects					
I would like the lecturer to use a consistent colour scheme in the PowerPoint slides within the same lecture					
I find it helpful if each slide is revealed all at once, even if it is ahead of the lecture					
I feel that there is no need for the lecturer to supply a paper copy of the PowerPoint slides, as they are available on WebCT					
When I have a copy of the presentation beforehand, I find it easier for my mind to wander since I have already seen the material					
I find it boring when the lecturer says the same things the PowerPoint slides say					
I prefer slides that contain pictures, charts or graphs only					
I feel the lecturer should only give an outline of the lecture on the PowerPoint slides, as I would learn more in the lecture if I had to write some of the material					
When I have a copy of the presentation, I am less likely to attend class since I already have the material					
I wish the lecturer would spend less time using PowerPoint slides					

General comments