Multimedia Learning and the use of images in lectures - evidence from a three year trial across 9 academic disciplines (0001)

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We live in the visual era, yet HE lectures are dominated by text, often excessively so. Our students' generation has never been so influenced by images, and yet we rarely match our teaching to this learning reality. Multimedia Learning (MML) theory maintains there are very sound pedagogic reasons we should embrace the visual in teaching. This paper discusses the development and application of a visual lecture method deploying high quality full-screen literal and figurative images that communicate complex matters visually, complementing text. It then presents empirical data gathered from testing this method's impact on student engagement and understanding in large group lectures over a 3-year period, across 9 different disciplines. The data affirms hypotheses of leading MML theorists and paves the way for wider research using specialist web-based research tools developed during this research exercise.

Background information and context of the study

This project is rooted in the published research on Multimedia Learning (MML), most commonly identified with Professor Richard Mayer (Mayer, 2014). Mayer's work on MML suggests that we can teach better with images and text on our PowerPoint slides, than with just text. This is because we are 'dual processors' whose learning abilities are better served by dividing information between images and text to balance the load on our cognitive capacities – instead of pushing everything through text-processing whilst underexploiting visual processing capacity. His work predicts better engagement and understanding using this approach, and is backed by deeper, historical research on cognitive capacity and memory published over the last 50 years (Paivio, 1971). Others have begun the process of evaluating these theories but lack scope. For example, Johnson and Christenson's work (2011) articulates a variation in the use of PowerPoint that accords with Mayer's model and was found to be more appealing to students; but the research went no further than establishing 'satisfaction' with the use of images. Similarly, Tangen et al (2011) ran 'quasi-experimental' testing of a visual approach but again were concerned more with learning outcomes and less with student engagement or the forms of pedagogy with which this proposal is concerned. This project builds on existing scholarship but takes it in the direction of the key international Higher Education agenda of 'engagement'.

Methodology adopted

Over three years, I developed from Multimedia Learning theory a visual method of teaching large groups that used full-slide images embedded in PowerPoint slides. I used this method throughout all the modules I taught which covered 9 disciplines (because of the nature of the School and intra-university cooperation). I was interested in testing the extent to which MML methods predict student engagement. I used a mix of quantitative and qualitative methods.

Quantitative data comes from an adaptation of the comparative approach of Kleinman and Dwyer (1999) and Chanlin (1998), who wanted to compare three different means of delivering the same subject matter. For their experiment, they recruited three groups of people to observe slides with text, slides with images and slides with moving images. I wanted to compare only two forms of delivery, involving student reactions to slides with text, and to slides with images. Student volunteers

came from all 9 academic disciplines that I have been teaching using this method for 3 years. All who volunteered were recruited. The trials lasted 3 years. The tests were identical each year and provide longitudinal and horizontal data but could be enhanced by increasing the number of participants. Some of the students were financially-incentivized, which increased participation 700%. The data from this cohort mirrored non-incentivized student data. We also placed both presentations (text slides and image slides, each with my voiceover) online and connected them to the survey through a mutating URL that randomizes participation. That research website was disseminated via various student portals and increased participation 400%. It has also been developed to engage dyslexic students in the same research. Over the three years, the total number of student participants in the quantitative testing was 180 (1 test each semester involving 30 students; 2 semesters per year = 60 students; 3 years of testing = 180 students)

Qualitative data comes from focus groups, which were able to explore the outcomes of the quantitative method above. In each group there were between 3 and 7 students in 2 semesters over 3 years = c. 30 students.

Preliminary results

Initial testing reveals a substantial preference for slides with images in all groups over the three years. This confirms the MML hypothesis that images and words are better for engagement and understanding than words alone. This is explained in large part by two processes co-existing simultaneously. First is the addition of images, which are processed through the visual cortex, normally under-exploited in lectures because of the general absence of large, apposite imagery (Paivio, 2007). Their presence engages different areas of the brain that enable faster processing and better recall leading to a Picture Superiority Effect (Hockley, 2008). Images also are capable of explaining complex issues by generating paradoxes that force mental engagement (Ayres, 2015). Second is the subtraction of excessive text. It is widely understood that filling slides with text can disconnect students from the topic; the process is known as ‘Death by PowerPoint’ and is broadly acknowledged (Choudhury & McKinney, 2013; Coats, 2006). Excessive use of text overloads cognate capacity and the ability to process knowledge. Combined, there is a bottle neck in the learning process that can be eased by streaming images through under-used visual processing capabilities, while simultaneously reducing text that overloads processing capacity. It is a balancing issue. In addition, focus groups revealed that many students felt they were ‘there’ in the image when it was discussed. They said that images helped make ‘real’ what they were studying, and generated a connection with a subject. They often agreed that there was an empathic relationship opening up with some of the images and that emotions, in this case, made them want to engage, understand and learn more about a given situation.

Explore the implications of the study (eg for theory, practice and further research)

The implications are substantial. First, existing approaches to lectures that privilege text may be harmful pedagogically speaking, because excessive text ‘chokes’ learning and disengages students. The literature suggests we are overloading one pathway to learning and leaving the other one under-used. The overload distances audiences (not just students), and reading slide text at the same time as trying to hear the speaker divides attention and undermines the potential benefits of both. Reading text from slides makes one or the other (text or voice) redundant. Focusing on one reduces the ability to focus on the other. This applies in a broad range of presentations in the non-natural science field.

Second, liberating visual processing capacity makes lectures easier to engage with and understand. At a time when 'engagement' is the latest buzzword in relations between state and HE, this is an original and useful means to take this agenda forwards. It also helps students understand what we are saying by exploiting under-used visual processing power: a picture's worth a thousand words. This is all the more significant given the visual era our students have grown up in. It makes our pedagogy relevant to their leaning experiences prior to attending University (Coats, 2006; Barber, 2007).

A third implication is the expansiveness of the approach. I tested the use of images across 9 academic disciplines and found the results were mirrored in all 9 subject areas. This means, unsurprisingly, that sighted undergraduates in many academic areas will likely benefit substantially, across all Higher Education outlets in the UK and more broadly. Commonality of the dual processing capacity to human beings suggests broad applicability globally.

It isn't a silver bullet. Some students favour and value text-heavy slides. They are in a small minority in the data gathered in this testing. But these needs too can be assimilated into a visual approach, by placing text in 'notes view' and making the slides accessible online or by providing traditional paper handouts to accompany visual lectures. In addition, research conducted with dyslexic students and disseminated the British Dyslexia Association's International Conference in March 2016 affirm the academic value and social popularity of this approach for neurodiverse students – and expanding percentage of the present student body.

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