# LARGE GROUP TEACHING AND TECHNOLOGY – DON'T THROW THE BABY OUT WITH THE BATHWATER.

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*The Information Age brings to the teaching and learning environment new capabilities, new opportunities, new language, new work - and skills requirements, new roles and last but not least, a new generation of learners. Teaching in the information age requires that you apply and use technology in an attempt to accommodate these new requirements. Gone are the days that you only talk-and-chalk or flip slides on the overhead projector. But, beware of teaching with all the bells-and-whistles and failing to facilitate real learning. In this presentation I would like to share my experiences of teaching large, culturally diverse groups using technology but sticking to the sound principles of teaching and learning.*

## INTRODUCTION

The information age with the mass of technology it brings can be both blessing and curse for the teaching and learning environment. As lecturer and teacher one is confronted with new roles, new work, new decisions, new skill requirements, new language, and last but not least, a new generation of learners (with their own unique new excuses!).

On the other side of the coin there are unprecedented opportunities to use technology to enhance learning, to increase the excitement of the subject matter and to expose learners to their subject in "real life". This brings with it the temptation to use all the "bells and whistles" of the wonderful hardware and software available, and leaves many of us confused and overwhelmed as to what is useful and what is over the top.

One thing is fairly clear though: "chalk and talk" or overhead projector slides alone probably don't cut it anymore for most students who have been born into this era of technology boom. We all have to confront the reality that technology and change is here to stay, and we somehow have to find the best ways to incorporate it into our lecture halls and classrooms.

I further believe that statistics education is very well suited for the use of technology and multimedia. In fact, I think it is imperative that we expose students to it early since they will be using it daily in their careers.

I would like to contribute to our collective knowledge of technology in education by sharing my experiences of using technology to teach large culturally diverse statistics student groups in Gauteng, South Africa. I am by no means an expert on the use of technology in a tertiary setting, but I believe that my journey of getting to know the vehicle of presentation (PowerPoint™, as technology) and the recipient (multicultural learners with unique learning styles) will be helpful to many of you in your unique setting.

## KNOW YOUR AUDIENCE

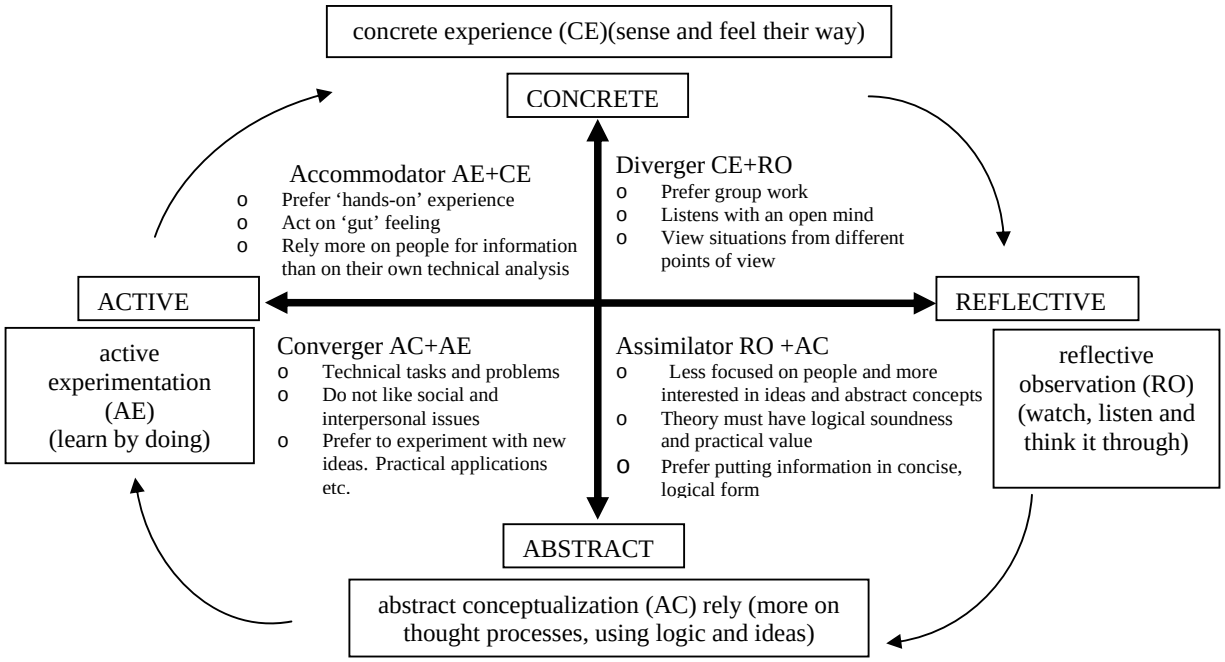
One of the most basic principles when giving a presentation is to know your audience. Nowhere is this more important than when you want your audience to learn effectively – in other words, how your students learn must influence how you teach and will therefore also influence how you use technology "vehicles".

How do your students learn? An easy question to ask, but not so easy to answer. Recent literature contains at least thirteen learning theories, and in this paper, the *Experiential Learning Model* (ELM) by David A Kolb will be illustrated and discussed. Reasons for deciding to use this model included the fact that it is an extremely well-researched framework with a *Learning Style Inventory* (LSI) (Kolb & Kolb 2005) which I used, and because it embraces a focus on the learner as an active participant in the learning process.

*Experiential Learning Theory* (ELT) defines learning as "*the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience*" (Kolb 1984). Shepherd summarises the model as follows: "*Learning may begin with a concrete, or immediate, experience. The learner observes or reflects on that experience. These observations and reflections are accommodated (in cognitive terms) by abstract conceptualisation; i.e. by distillation into a theory, concept or generalisation. The theory, concept or generalisation is then tested for validity by active experimentation (i.e. action), which results in further concrete experience as the process moves into another iteration of the cycle*" (Shepherd, 2003). For example, when introducing the concept probability one may begin by simulating the flip of a coin in Excel, assuming that you do have a computer and data-projector in the lecture hall. As one increases the number of events the relative frequencies of the outcomes "heads" are automatically plotted. Students will identify the "in-the-long-run" pattern that emerges from the experiment and "abstract conceptualisation" and "generalisation" will kick in when they formulate a definition for probability. The theory is then validated by active experimentation, for example, by simulating the throw of a die during a practical session.

The ELM represents learning that requires each of four different types of ability, or modes of learning - concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualisation abilities (AC) and active experimentation abilities (AE) (Kolb, 1981). Kolb stressed that learning *requires all four types of ability* and further proposes that a particular learner may favour, and tend to use more, one or more of the sets of abilities in preference to the others, according to how effective and comfortable he feels with each stage when learning and/or solving problems. Each person, in a unique way, develops a learning style that has both strong and weak points. The ELM has been summarised in Figure1. Note that the vertical (Concrete/Abstract) axis relates to *how a learner perceives new information* and the horizontal (Active/Reflective) axis addresses *how a learner processes new information*. The arrows indicate the learning "cycle". Every quadrant is a combination of one of the vertical and one of the horizontal characteristics and is named diverger, assimilator, converger and accommodator. The LSI (Learning Style Inventory) positions the learner in one of these quadrants as his or her "preferred"-mode of learning.

Figure 1: The Experiential Learning Model (Kolb, 1981)



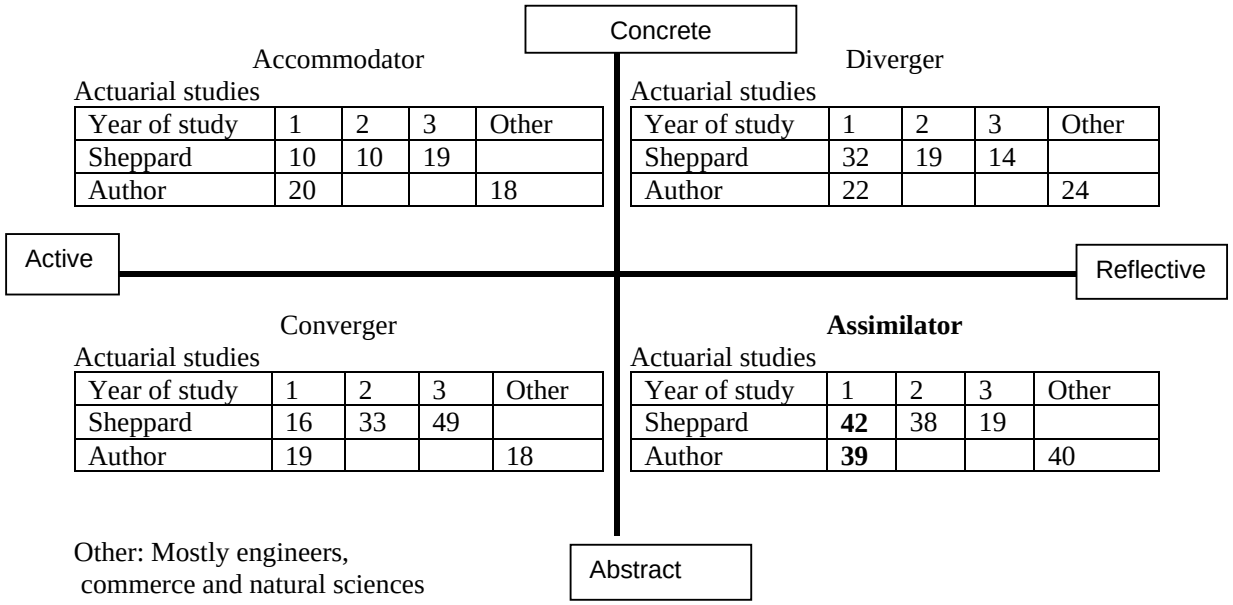

At this stage you might say, this is good and well, but how would you go about accommodating all the combinations of learning styles in a class of 300 learners? Fortunately

things are not usually quite so complex at tertiary level. According to Kolb (1981), individuals tend to choose academic fields and careers whose learning environment support and nurture their own style of learning. In other words, there is a good probability that the majority of students in your lecture hall have similar learning styles if they have chosen similar courses or fields of study.

This is indeed what I found when I used Kolb's Learning Style Inventory on my 340 first year Mathematical Statistics students. Of these students 40% are Actuarial Science students, 15% Computer Engineering, 10% Computer Science and the rest natural science. The results indicated that most of my class were "Assimilators" - and, unfortunately, so am I. I do see this as a disadvantage because, even though students with the same learning style as I will feel comfortable with my mode of lecturing, I needed to "force" myself to apply modes of lecturing that I myself do not feel quite at home with so that the students are exposed to other learning styles which will broaden their thinking abilities. I would prefer to march in the lecture hall and give a very good, well-structured PowerPoint lecture from the first (bulleted) outcomes to the last (bulleted) conclusions without much inter-student-contact. However, from day one I consciously decided to introduce "buzz-groups" with clear outlines how the groups were to function. Some of my colleagues were very sceptical when they heard that I was doing group-work in such a big class, but with the clear procedures it poses no problems. Technology interspersed with other tried and tested teaching techniques such as "buzz-groups" worked very well for my particular group of "Assimilators" – both for addressing their preferred learning style and for stretching their horizons.

I subsequently came upon a survey done by John Shepherd on the preferred learning styles of Australian actuaries. During 1995/96, and 1998, over 1,000 students at Macquarie University were surveyed to determine their preferred learning styles according to Kolb's Learning Style Inventory (LSI) (Shepherd, 2003). The results of both my study and that of Shepherd have been combined on the following tables and presented on the ELM-quadrants (Figure 2). I do not have results for second and third year students but I included the results of my not-actuarial students to show that there profile did not differ that much from those of the actuarial students.

Figure 2: Percentage distribution of university students by learning style type




In his publication, Shepherd, asks "What learning styles should we expect from actuarial students" but also "What learning styles should we expect from actuaries". The answer to the first

question is obvious from the results, but in the second question he outlines properties that an actuary should have that is not a "natural" property of an actuarial student. For example, he states: 'Many actuaries operate as consultants, with corporate or individual clients. Such roles often involve extensive interaction with people, including investigative interviews to determine clients' real concerns and needs or to gather information, teamwork with actuaries and other professionals, and communicating the results and implications of technical or complex analysis to non-technical audiences" (Shepherd, 2003). These activities require personal interaction skills (concrete experience) as well as problem solving and decision making (active experimentation). For precisely these reasons it is important not to throw any babies out with their bathwater and use only technology (e.g. PowerPoint) exclusively to the detriment of other excellent teaching practices such as group exercises, or to disregard the power of technology in a group setup. We need to find out how we can use technology to best advantage in large groups and still find ways to develop the skills we want in our learners.

## POWERPOINT™ AS PRESENTATION SOFTWARE

PowerPoint™ is probably one of the most commonly used software presentation packages, at least here in South Africa. There are truly many publications on the advantages and disadvantages of using PowerPoint™ as presentation media. One source that I found most informative was an interview with Richard Mayer, a prolific researcher in the field of educational psychology. He is the author of 18 books and more than 250 articles and chapters with 12 years of research in multimedia learning and problem solving.

The following insightful hints come from an interview with Richard Mayer by Cliff Atkinson (www.sociablemedia.com) I have emphasized aspects I thought particular applicable or important.

Mayer distinguishes between using PowerPoint™ for information presentation, for example at a conference, and cognitive guidance that fits more in the lecture set-up. He remarks: "When your goal is cognitive guidance, you want to make sure that the audience members build appropriate knowledge in their memories. Your job is to communicate in a way that will have the desired impact on the audience, so you need to *design your slides so they are consistent with how people learn.* In my opinion, many of the examples of misuses of PowerPoint occur when the slides are designed to *present information rather than to guide cognitive processing.* In short, like any communication medium—including books, PowerPoint can be misused as a device for presenting information without regard for how the audience will process the presented information."

Mayer is the author of a book *Multimedia Learning* (Cambridge University Press, 2001*)* and the next question in the interview was: "Do your research findings in multimedia apply to PowerPoint users as well?" At this stage I would like to list his principles for the design of multimedia instructional messages and one can decide how it is applicable in the design of the PowerPoint slides:

- Multimedia principle: people learn better from words and pictures than from words alone, for example, talking about the time-series components alone versus talking and showing, at the same time, electricity usage of the past 10 years in your area.
- Coherence principle: people learn better when extraneous material is excluded rather than included. You should ask yourself whether that graphic that you added to your line graph is really necessary, whether it adds to the understanding of the trend or is just "beautifying" your slide. Make your students aware that they should stay away from "impressive" three-dimensional bars when presenting a bar chart and lots of cute, but irrelevant, clip art.
- Contiguity principle: people learn better when corresponding words and pictures are presented at the same time or next to each other on the screen;
- Modality principle: people learn better from animation with spoken text than animation with printed text; I will use animation, for example, when proving a theorem. As we discuss what the next step should be I will click my remote presentation mouse and the next step will appear, with the emphasis on appear, not "fly in" or "spiral in". My physical presence is NOT

in front of the overhead projector but with the students and I have control over the tempo of the presentation.

- Signalling principle: people learn better when the material is organized with clear outlines and headings, for example, the headings coincide with the chapter/paragraph numbering in the prescribed textbook; and
- Personalization principle, in which people learn better from conversational style than formal style.

The following comment from Richard is, according to me, the most important one: "Although there is not yet a rich literature containing high quality research on PowerPoint, there already is an extensive literature on how to design paper-based instructional messages. It is worthwhile to make a distinction between media and methods. Media refer to the delivery systems for communication such as books, computer screens, or PowerPoint presentations. Methods refer to the instructional methods used to help people learn. Research on instructional design has shown that the presentation medium does not create learning, but the presentation method does affect learning. Thus, *PowerPoint does not create learning but the method you use for presenting information on PowerPoint does affect learning*. For this reason, instructional methods that work with paper or e-learning are likely to also work with PowerPoint."

## CLOSING REMARKS ON THE USE OF TECHNOLOGY

Students expect it. My beginning-of-the-year survey showed that 53% of the class "Fully expect" and a further 42% said "It would be nice" if the lecturer used presentation technology.

When I asked a student her opinion on my PowerPoint-presented lecture her complaint was: "it was click-click-click, and I got lost". So yes, beware, the use of PowerPoint tends to speed up delivery, often to the point when it is difficult to follow the lecture. Make PowerPoint PART of the lecture, not THE lecture. Incorporate it with group discussions and white-board explanations.

The use of presentation graphics makes my lecture more "real-life". For example, as an introductory lecture on Chi-square I will take them, with graphics, on a trip to a casino that leads to the roulette wheal and the practical problem of testing the randomness of the 37 outcomes. The Internet is a rich source of graphics, for example, key in the word "logistic fit" in images.google.com and you will be led to applications like SARS or mad-cow-disease. Many a student has come to me and said that I made them love statistics because I show them where it is applied. I don't know how I would have accomplished this without presentation graphics.

A big advantage of having a computer in the lecture hall is the fact that you can easily demonstrate something in a statistical package, for example a simulation in Excel or a program in SAS.

Most universities have a web-based communication system in place. I will make use of this to publish my slides, announcements and assignments etc. This is also a very useful forum to look at some of the students comments, for example:

"can the slides for each lesson please be put up either in advance or immediately after the lesson because we use them to get the actual writing after class because we can't both write and listen during the lecture. Please this would be highly appreciated."

Finally we can ask, will large groups of students really benefit from instructional technology? Apperson et al (2006) concluded that results suggest that organization and clarity, entertainment and interest, professor likeability, and good professor behaviours were enhanced with PowerPoint although final grades were not. Szabo and Hastings (2000) concluded that there were no significant differences between the two PowerPoint lectures both of which resulted in higher grades than the overhead lecture.

If one considers evaluations based on academic performance, then I think research on the effectiveness of instructional technology probably still produces mixed results. However, we should consider that learning is much more than just a final test score. The next step in education, statistics education included, is "to design and implement programs and curricula that promote maximization of student learning and more holistic, experiential modes of assessment" (Kolb, 2005). The further challenge is to effectively implement technology to reach this goal. We can do

this by considering the learner as a whole – including aspects such as learning styles – and adapting our teaching and technology to fit the learner accordingly.

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