

Promoting Active Learning in University Classes

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January 11

Introduction

This workshop follows on from the four earlier 'active learning' workshops conducted in EDC. Approximately 100 staff attended one or more of these and as a result we were asked to offer a version within departments – hence this session. In this workshop we will discuss and experience a range of things that teachers could do to get their students actively involved in large or small classes. 'Active' includes thinking, problem solving, discussing, creating, cooperating, contributing, questioning, and so on – all things that move the classroom experience from a didactic to an interactive process.

Materials

This handout consists of a number of resource sheets, a set of readings on active learning, a range of 'active learning' techniques and activities, a 'test', and an evaluation form.

Rationale

Active learning isn't a new idea. It goes back at least as far as Socrates and was a major emphasis among progressive educators like John Dewey. And yet, if you look into many university classrooms, we seem to have forgotten that learning is naturally an active process. It involves putting our students in situations which compel them to read, speak, listen, think deeply, and write. While well delivered lectures are valuable and are not uncommon, sometimes the thinking required while attending a lecture is low level comprehension that goes from the ear to the writing hand and leaves the mind untouched. Active learning puts the responsibility of organizing what is to be learned in the hands of the learners themselves, and ideally lends itself to a more diverse range of learning styles.

Learning is an active process. In some way a student must be actively engaged in the class, with the materials, solving problems, processing information, evaluating evidence, and so on. This can be alone or with a peer or in a group. It can be in class or out of class. It might be reflecting on moral dilemmas or considering a specific technical problem.

It is the teacher's job to promote active learning by moving away from being content focused to student focused and providing opportunities and motivation to get students actively involved with the materials and each other.

Fundamental issues

- Teaching is made up of two parts – the CONTENT and PROCESS
- Education and learning is an ACTIVE process – always by the learner;
- Teaching is about changing the learner in some desirable way – in terms of knowledge, skills and attitudes.

Plan for the session (a guide only – may be changed)

This session will model a university tutorial. Participants will be exposed to a range of methods and techniques suitable for university teaching. The content covered will include active learning; characteristics of student learners; principles of teaching; qualities of teachers; student centred learning; and appropriate methodologies.

10	Introductions and concerns / needs / expectations (Getting students speaking – warming up the group)	Think Pair Share Concerns / needs
10	Basic concepts and ideas	Discussion, Active, Groundrules, Content - process
30	Characteristics of the student learner	Pyramid technique
20	Qualities of teachers	Diversity exercise
10	Summary and feedback and discussion	What will you do?

TEACHING
is made up of two basic parts

The CONTENT
- what is to be taught

The PROCESS
- how it is to be taught

EDUCATION
is an **ACTIVE** process

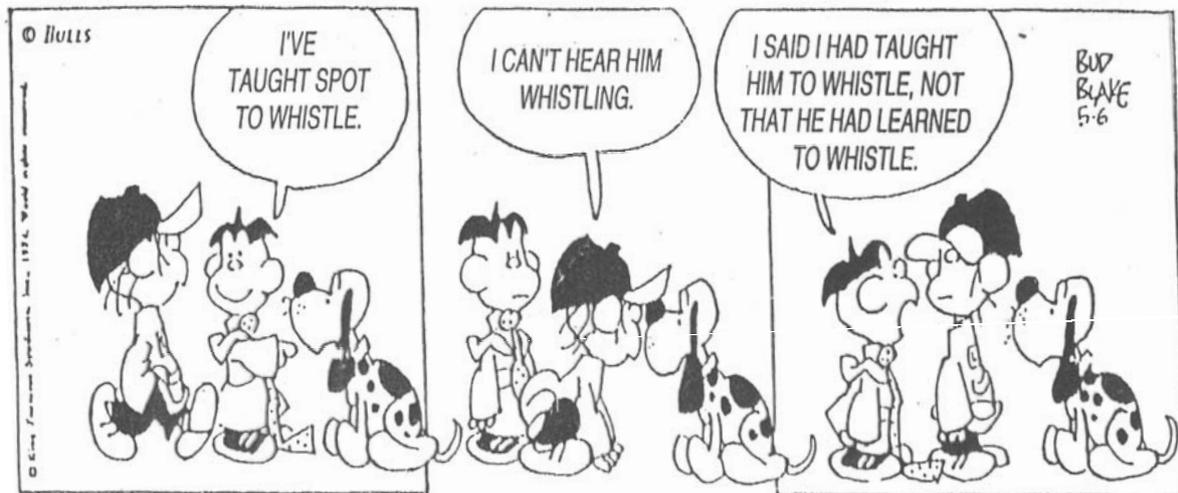
The learner **MUST** be active

The teacher **MAY** be active

A teacher's job is to **FACILITATE**, i.e. help, the learning
by students

A teacher must also **MANIPULATE** the process and the
environment in which learning can take place

Therefore a good teacher is a **FACIPULATOR**



Promoting higher order thinking appropriate to university students!!

As far as possible in education especially higher education we should be promoting learning where higher order cognitive and other skills are learnt – therefore try to ensure students are performing at the upper levels of the following hierarchy -

Bloom's taxonomy of educational objectives

Knowledge	Simple recall of facts <i>Action verbs include define, describe, identify, label, list, match, outline, reproduce, select, state</i>
Comprehension	Understanding the material <i>Action verbs include convert, defend, distinguish, estimate, explain, extend, generalize, give example, infer, paraphrase, predict, rewrite, summarize</i>
Application	Apply rules, methods and principles to specific situations <i>Action verbs include change, compute, demonstrate, discover, manipulate, modify, operate, predict, prepare, produce, relate, show, solve, use</i>
Analysis	Breaking the information or procedure into component parts <i>Action verbs include break down, differentiate, discriminate, distinguish, identify, illustrate, infer, outline, point out, relate, select, separate</i>
Synthesis	Combining various parts into new wholes – creativity <i>Action verbs include categorize, combine, compile, compose, create, devise, design, explain, generate, modify, organize, plan, rearrange, revise, categorize, combine, compile, compose, create, devise, design, generate, modify, organize, plan, rearrange, revise, rewrite, summarize</i>
Evaluation	Judging the value of information, ideas, and procedures. <i>Action verbs include appraise, compare, conclude, contrast, criticize, discriminate, explain, justify, interpret, relate, summarize, support</i>

Characteristics of the STUDENT learner

1. Students typically start learning experiences with a high level of motivation to succeed.
2. When new learning is linked to what they already know or to their past experience, students can learn quickly and effectively.
3. Students tend to be set in some of their ways of thinking and behaving – they may have to unlearn things that otherwise block new learning.
4. Students learn best when they have had a share in developing the learning goals.
5. Students like to see the relevance of any piece of learning to their lives.
6. Students learn at varying rates and do best when this is allowed for and they are not in a strongly competitive situation or against the clock.
7. Students learn best when they are physically and mentally comfortable – when they know and feel at ease with their teachers and fellow-students.
8. Student learners prefer to be actively involved in the learning process.
9. Students bring to learning a great deal of knowledge and experience which the tutor can draw on.
10. Students need to experience success in their learning as quickly and often as possible to maintain and increase their motivation.
11. Students are often the best judge of their competence or performance.

Questions

From your own perspective as a tutor / teacher in university, which four of the above characteristics would you consider *most* important?

Why did you pick those ones?

Characteristics of 'good' and 'bad' lecturers, teachers, tutors etc.

GOOD

BAD



'Teaching methods that never fail' is found in the fiction section

The Pyramid Technique

Step 1	Individual work (3-5 minutes)	<ul style="list-style-type: none"> • focuses student on topic • reduces pressure later on • reminds each student that he/she has a contribution to make
Step 2	Work in pairs (3-5 minutes)	<ul style="list-style-type: none"> • reduces nervousness • builds contact in group • balances out vocal/ non vocal students • involves everyone • creates a good working atmosphere
Step 3	Small group work (10-15 minutes)	<ul style="list-style-type: none"> • more free ranging discussion • individual has support of a partner • most productive discussion takes place • students learn from each other
Step 4	Whole class	<ul style="list-style-type: none"> • sharing of ideas • generates further insights • builds group cohesion • students can ask questions from teacher

Why this is a good technique

- It empowers students by affirming what they each know and what they collectively know. It is common to find that the group already knows much of the knowledge or content that we feel we need to teach.
- It is an open ended process which avoids the orthodoxy of the one 'right' answer. Instead it focuses on better ones, and the range of better ones.
- It is student centred yet the role of the teacher as a guide, facilitator and resource person is also important.
- Everyone gets the chance to speak in non-threatening contexts
- Students are encouraged to work on problems co-operatively which encourages a sense of interdependence rather than competition.
- It encourages students to critically reflect on their own shortcomings as students in a context where, at the same time, they can learn from others.

Here is a simple multiplication problem, the student's working, and the solution.

$$\begin{array}{r}
 169 \\
 \times 43 \\
 \hline
 6760 \\
 497 \\
 \hline
 7157
 \end{array}$$

You have ONE MINUTE to give it a mark out of ten.

EXPLAINING CONCEPTS AND IDEAS

Explaining is one of the key tasks of a teacher / tutor / lecturer / presenter. The following exercise gives participants the opportunity to try and explain a difficult concept or idea and also generates the qualities and characteristics of a good and not so good explanation.

1 In pairs, pick a relevant idea, concept, process or technique that you might have to explain to a class, and explain it to your partner.

Take turns: You have two minutes each (Note the things that were good about the explanation you hear as well as the things that could be improved.)

2 Join with another pair to form groups of four. Each of the four people explain to the others what has just been explained to them.

Take turns: You have one minute each. (Again note the things that characterised the good and not so good explanations)

3 As a group discuss the explanations and develop a list entitled 'Qualities and characteristics of a good and not so good explanation'

(You have ten minutes)

Good explanations are.....

Poor explanations are

Five minute test

List 4 'active methods' developed during this session that you might use in your classroom.

1

2

3

4

Answer the following questions in your own words!

1 Why should we promote 'active' learning?

2 Why do we assess students learning?

3 Why are students difficult to motivate?

Some more 'active' teaching strategies to try in classes

Think – pair – share	Each person considers the topic/question and writes down some ideas/answers. S/he joins with one other for discussion. This provides a good basis for wider discussion.
Extremes	Each person thinks of the 'best' and 'worst' or 'positive qualities' and negative qualities' of something. These are collected and discussed to generate a ranking of 'extremes'.
Whole to part to whole	Teacher or expert demonstrates a process or skill. One or more participants try the skill and show difficulties. The skill is broken down into small parts and learnt and put together with discussion.
'Buzz' groups	Working in small groups, people discuss an issue. Topics can include: <ul style="list-style-type: none"> • How much they already know about a topic • What they are not sure about • What they want the lecturer to cover next
Round	Every person takes a turn to make a statement. Useful topics: <ul style="list-style-type: none"> • One thing I need to know about ... • Something that I learned today • One important point (about the topic) ...
Case studies	A 'story' or scenario is presented to the group (often, but not always, as a handout). Groups discuss the story or work together on questions.
Group discussion	Groups (up to 6 people) talk about a topic. A set of questions from the lecturer helps to structure the discussion and focus the group. The larger the group, the more difficult it is for everyone to participate actively.
'Tell your partner'	Pairs. Each person explains a topic/concept/ answer to someone else. The partner has to listen, then ask questions.
Fishbowl	One group discusses a topic. The second group observes the discussion and each person records: A partner's contributions (and gives individual feedback afterwards), or The important parts of the discussion (may be identification of issues, applications, generalisations, etc., depending on the task instructions)
Role play	Groups/ pairs/ individuals 'act out' information on a specific topic, often in front of the class or group. If they lack confidence, they can work in pairs without 'performing' in front of the whole class. Set a time limit for each group. This activity can be used for formative or summative assessment. It is important to allow time for participants to de-role/debrief.

Presentations	Individuals or small groups find information on a topic, then prepare and deliver a short informative session to the wider group.
Panel	Several 'experts' are invited to the session and answer questions from the class. The experts may be from industry, other teachers, and/or students. They may each speak briefly before the question session.
Question and answer session	This is a useful activity to check students' understanding. A time is set aside for a discussion/answer session. Questions may be submitted in writing at the previous session (good for shy students), they may be oral.
Syndicates	Groups of students work together on a project(s) which entails researching and presenting (written or oral) information. Useful for focusing on group skills while covering discipline content.
Brainstorming	Everyone thinks of as many different ideas as possible. All ideas are accepted and recorded without comment. The ideas are evaluated after a set time period or when inspiration ends.
Information transfer	This is a paired activity. Partners ask each other questions and give answers to fill gaps on their worksheets. (Each worksheet has different gaps.)
Matching	This activity is one way to divide a large group into pairs. Members of the group are given cards which contain either a title or a definition. They have to find the person with the complementary card. In finding their partners, they come across a range of definitions and have to think about the topic. Content can be simple or complex depending on people's abilities. The pairs then work together on an exercise/problem related to their title and definition. Reporting back afterwards widens the learning.
Withdrawal	While the group works together or alone on set work, the lecturer spends time with individual students or small groups. The individual assistance can be rostered through the course so that everyone gets a turn, or it can focus on people who need extra help.
Mindmaps	A topic is written on the board (or on butcher's paper). The class/group suggests and organises ideas and information, presenting them visually, often in clusters. Students often enjoy writing on the board (bring several whiteboard pens); where numbers are large, this activity is better carried out in groups with a display of the results at the end.
Organising information	Information items are provided out of sequence. Students work (in pairs or small groups) to arrange them in order. The results can then be reported by each group and/or discussed by the wider group. The information can be given to students on a single worksheet or already cut into pieces for them to arrange in order.

- Demonstrations** The teacher shows students how to do something, or uses equipment to explain theory/principles. This activity can also be presented by a student or group. Seeing something real helps students to remember more clearly.
- Experiments** The teacher or the students carry out a practical activity to verify or refute a principle.
- 1 – 2 – 4 – more (pyramid)** Each person writes brief notes about the topic and then compares them with a partner. Each pair discusses its combined list with another couple. This provides a good basis for discussion in the wider group. It is a good idea to limit the ‘1 – 2 – 4’ stages, eg 2 minutes or so for individual and for paired work, 5 minutes for the ‘4’ stage.
- Show of hands** This quick check is useful for gaining a rough idea of how many people are confident about a topic. It is worth remembering that confidence is not always the same as understanding. This activity is a good ‘energiser’. It is particularly useful at the beginning of a session to focus attention, or when the group has been sitting still for some time.
- ‘Ignorance’** Before the class begins, students consider what they would like to know by the end of the session. They write down some questions - five is a good number to aim for. Some students may like to share their questions, which can be recorded on the board. The students write more questions at the end of the session. These questions are likely to be different from the earlier ones; they should involve a higher level of thinking; there may well be more of them; and they can be a useful basis for further private study.
- Interactive handouts** Instead of providing complete copies of the PowerPoint slides or OHPs give out sheets with various parts missing. These could be mathematical, formulaic, descriptive, analytical, and so on. The students need to complete the materials for them to be useful. Good for in class problem solving
- Quick quiz** During a class or randomly have a quick quiz on the material just covered. This could also take the form of a problem solving exercise and groups or individuals can compete for speed and accuracy.
- Transforming** Take a set of data or information and transform it into another form. For example a list of characteristics could be transformed into a set of action statements. If learners ‘prefer to have relevant content to study’ this could be restated as ‘ensure the material used in class is relevant to the learner’.
- Problem generation and solving (fears / problems in the box)** Individuals or groups consider a topic, issue, process, case, etc and raise problems or difficulties. Each person or group write the problem on pieces of paper which are folded and put into a box. The ‘problems’ are then redistributed and solved by others and shared.

Active Learning Research Summaries

A consistent theme of faculty at colleges and universities is that they are not aware of the educational research that currently exists or how it applies to their teaching. The purpose of this section is to provide summaries of research articles that can inform classroom practice. Explore one of the following.

- Talk six minutes less and students learn more!
- How dense should information in a lecture be?
- How to make lectures more clear.

Ruhl, K. L., Hughes, C. A., & Schloss, P. J. (1987, Winter). Using the pause procedure to enhance lecture recall. *Teacher Education and Special Education*, 10, 14-18.

In this study an instructor paused for two minutes on three occasions during each of five lectures: the intervals ranged from 12 to 18 minutes. During the pauses, while students worked in pairs to discuss and rework their notes, no interaction occurred between instructor and students. At the end of each lecture, students were given three minutes to write down everything they could remember from the lecture (free recall); 12 days after the last lecture, the students were also given a 65 item multiple-choice test to measure long-term retention. A control group received the same lectures (using the same anecdotes and visual aids) and was similarly tested. In two separate courses repeated over two semesters, the results were striking and consistent: Students hearing the lectures while the instructor paused did significantly better on the free recall and the comprehensive test. In fact, the magnitude of the difference in mean scores between the two groups was large enough to make a difference of two letter grades depending upon cutoff points!

The implication of this research is staggering, for it essentially says that *if we talk six minutes less, students learn more*. Undoubtedly these counterintuitive results stem from two things: 1) the short lectures (12-18 minutes) are consistent with the research that suggests that students' ability to retain information falls off substantially after 10-20 minutes; and 2) by engaging in an activity that reinforces the information presented, student learning should be increased. This study of Ruhl and others clearly suggests that we have an opportunity to include short, active-learning activities into our lectures with no loss to the content learned. Indeed, students seem to learn more from the process.

Russell, I.J., Hendricson, W.D., & Herbert, R.J. (November, 1984). Effects of lecture information density on medical student achievement. *Journal of Medical Education*, 59, 881-889.

Concerned about the explosion of information available in medical texts and the perceived need by lecturers that they must cover even more material in the limited time available, the authors studied the effect of information density on student retention. They prepared three different lectures on the same subject. Ninety percent of the sentences in the high-density lecture disseminated new information. By comparison, only 70 percent of the medium and 50 percent of the low-density lecture presented new information. During the remaining time, the lecturer reinforced material by restating key ideas, highlighting the material's significance, providing illustrative examples, and relating the material to the student's prior experience. The lectures were presented to a total of 123 students randomly distributed into three groups,

which showed no significant difference in cumulative GPA's. Finally students were given a pretest that showed no significant difference in their knowledge base, a posttest (1) immediately after the lecture, and an unannounced posttest (2) 15 days later.

Statistical results clearly showed that students in this study learned and retained lecture information better when the density of new material was low. The implication is that the amount of new information that students can learn in a given time is limited and that we defeat our purposes when we exceed that limit. [Who among us has not gone over the allotted class time by a minute or two to provide "just one more thing"?] This study suggests, however, that we would be better off presenting only the basic material necessary to achieve our learning objectives: approximately only 50 percent of the material presented in any lecture should be new. The rest of class time should be devoted to material or activities designed to reinforce the material in students' minds.

This study is significant since one of the chief barriers always presented by faculty to the acceptance of active learning is that "there is simply too much content to cover." Apparently *less* new content and more time reinforcing the facts and concepts presented [which could include active learning] will lead to *greater* student learning.

[The following is abstracted from Chilcoat, G. W. (1989). Instructional behaviors for clearer presentations in the classroom. *Instructional Science*, 18, pp. 289-314. Chilcoat did a meta-analysis of ninety-five articles, thirty-five of which presented research at the college/university level. Each study showed that the behavior suggested had a significant effect either on student achievement (learning) or perception at the $p < .05$ level.]

It is imperative that teachers provide lectures that are as clear as possible so that students can make sense of what is being presented. Understanding allows students to retain, recall and apply material in other circumstances. Failure to understand often leads students to incorrectly interpret material or, in frustration, to ignore what has been said. In the past, many instructors believed that comprehension was entirely the students' responsibility. As we become more knowledgeable about cognitive research, however, it is apparent that much of that burden is the responsibility of the instructor as well. The question, of course, is how do we explicitly make our lectures more clear to students? Chilcoat's synthesis of the research suggests the following.

1. Provide a preview of information prior to an explanation.

Research suggests that this can be done effectively in one of three ways: An overview, designed to familiarize students with what is to be learned, can both facilitate student achievement and create positive student perception of a lecturer's presentations. Specifically an overview should be short and precise, providing a statement of the overall idea to be presented, the importance of the information to be learned, and a statement that outlines the structure of the content to be presented.

A second preview is called a set induction, which consists of two parts. Prior to the presentation, students are given a commonly known referent in the form of an analogy. During the presentation, new information is constantly referred back to the introductory analogy. This procedure allows students to link unfamiliar material with a concept they already understand. Research suggests this approach encourages student involvement, creates

a positive student perception of the lecture, and increases student achievement with regard to both short term and long term retention.

The third preview strategy is the advance organizer, which is an introductory statement at a higher level of abstraction than the detailed, related information in the presentation. The advance organizer, therefore, provides an appropriate conceptual framework, depending upon the age and level of the students, for understanding the material to follow. Also, the organizer should provide a link between students' previous understanding and the material to follow, giving concrete examples wherever possible.

2. Organize information within a step-by-step lesson sequence.

Chilcoat notes, "students tend to get lost in verbal mazes." When exposed to too much material at one time, student learning is reduced. The teacher, therefore, should carefully structure the lecture sequentially, arranging information logically, and breaking down material into clear, coherent, and explicit steps. "It is important that the presentation begins with information that is simple, concrete, familiar and explicit, then progresses to information that is increasingly complex, abstract, unfamiliar, unexplicit and long (p. 302)."

3. Assess student learning when information is being given.

The instructor should actively and frequently determine if student understand the material that has been presented. Specific strategies to engage students could include discussion questions, written responses (summaries, analytical lists, "what didn't you understand?, in-class journals"), formative (ungraded) quizzes, thumbs up/thumbs down, written problems, etc.. Whatever the technique, the goal is systematically and explicitly to see if students understand what was being presented.

4. Signal transitions between information.

Transitions are statements that are used by the lecturer to move from the introduction to the body of the presentation, between major points and subpoints, and from the body to the conclusion. Transitions allow students to switch attention between topics, maintain focus and reduce confusion. The key is to make the transition explicit, then to relate the previous information to the new information.

5. Use multiple examples to illustrate information points.

Well chosen examples illustrate and clarify the conceptual material being presented by making the abstract concrete and understandable. Multiple examples lead to increased student learning and retention of material. When providing examples, teachers should 1) use examples that are appropriate for the level of the student; 2) carefully explain why the example is significant and relevant; and 3) use examples in close proximity to the conceptual material being presented, and 4) obtain student feedback to see if the examples are understood.

6. Stress important points during explanations.

Lecturers need to draw students' attention to the material that is most crucial in the presentation being given. It is particularly important to stress anticipated difficult points, because detailed, redundant explanations for difficult concepts can lead to increased student learning. Other techniques include 1) writing and underlining key concepts on the blackboard; 2) enumerating points; and 3) using voice inflection or pausing after a point; or employing verbal signals such as "It is important to remember".

7. Provide for brief pauses at appropriate times during the lecture.

As a result of rapid teacher-talk students often are not given adequate time to process information. This has two consequences: 1) students have trouble taking good notes and 2) they often cannot make sense of what is being said. Research suggests that the amount of notes a student takes correlates positively with achievement. Yet, while teachers talk at a rate of 120-240 words per minute, many students are only capable of taking notes at a rate of 20 words per minute. In addition, one study (Ruhl, 1987) demonstrated that pausing periodically for as much as two minutes so that students could compare notes, led to a significant increase (both statistically and educationally) in both short-term and long-term recall.

8. Eliminate additional unexplained content nonessential to current explanation.

Research shows that presenting less is more effective.

9. Review information frequently.

Periodically during a presentation, but particularly at the end of difficult material, lecturers should review and summarize the main points. In addition, reviewing the entire presentation at its end, summarizing main points, is particularly effective. It is also effective to have students review what has been presented through the active learning techniques discussed previously. These reviews, carefully presented, demonstrably increase student learning.

