Thinking
Teamwork
Task-focused
Transcendence
Activate
a resource for HK PolyU Teachers

Apr 2005 Issue 6

Active Learning in Practical Classes

In This Issue

- *The focus is on maximizing the potential of practical classes.*
- *Two PolyU teachers describe strategies that work in different types of practical classes.*
- *Thinking tasks for practical classes are suggested along with a range of resources.*

Brown, G., & Atkins, M. (1991). *Effective teaching in higher education.* London: Routledge.

Oxford Centre for Staff and Learning Development, Oxford Brookes University. *Demonstrating in laboratories and practical classes.* http://www.brookes.ac.uk/services/ocsd/firstwords/fw111.html

University of Technology Sydney. *Teaching in laboratories.* http://www.iml.uts.edu.au/learnteach/resources/tm/laboratories.html

The Hong Kong Polytechnic University
香港理工大學

Educational Development Centre

At PolyU our mission is "Academic Excellence in a Professional Context". This emphasis on professional practice implies the acquisition of competence and knowledge. If we produce graduates who have "know how" as well as "know what" in their professional field, employees will prize PolyU graduates for their "practical intelligence".

More than "mind-numbing exercises in recipe following"!

In advice given to new teachers about labs and practical classes, the Oxford Centre for Staff and Learning Development (OCSLD) of Oxford Brookes University advise:

> "Bad laboratory and practical classes can be mind-numbing exercises in recipe following ... which turn students off practical work, or even off the discipline itself."

Hopefully, such situations are rare.

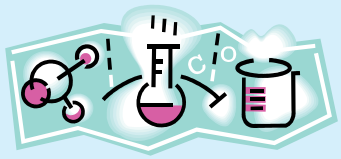
Goals make a difference

Students' learning in practical classes will be maximised when teachers carefully think about goals and learning outcomes. Drawing from Brown and Atkins (1991, pp. 91-114), the University of Technology Sydney, and Oxford Brookes University, practical classes offer students multiple opportunities including:

- Learning and practising observational and practical skills.
- Making mistakes in a safe environment and learning from them.
- Learning first hand about safe and ethical practices.
- Developing expertise in critical enquiry, problem finding and solving, experimental design, data analysis and presentation.
- Exploring personal knowledge, comprehension and conceptual understanding of a subject.
- Cultivating creative thinking and creativity.
- Becoming socialised into the culture of a discipline and learning how to communicate in the language of that discipline.
- Exploring some work-related dilemmas and difficulties.
- Nurturing professional attitudes.

These things don't happen by chance, or if we allow students to just to go through the motions ... following the "cook-book", so to speak. We need to challenge students to actively enquire, explore, question and reflect on their results and outcomes. In this way we increase the likelihood that they will construct their own knowledge, see things from different perspectives, learn how to work together, and develop the skills they will need to get and keep a job in the 21st Century.

Running Multi-Task Laboratory Sessions



Laboratory work is a core element of many science subjects. **Professor Iris Benzie** (SN) discusses her strategic approach to ensuring all students are actively engaged while in laboratory sessions. Her practical classes are closely aligned with lecture content, and course aims are well organised and closely supervised.

"I start by ensuring students know what we are doing, what the learning aims are for the session and how it fits into the larger picture. I want students to know what they will know or be able to do when they walk out of the room so that they see the relevance of every practical session. I give out a detailed laboratory sheet which contains the aims of the session, possible hazards, questions they should address and the equipment they will need.

"I don't want students to simply follow a 'cook-book'. I also want them to think. I build case studies and problem scenarios into practicals. Sometimes I allow students to swap data and discuss the findings. I want to give students enough structure to guide their work, but still allow for some freedom so that they are not frightened of making mistakes.

"One strategy that is very interesting is to build in a deliberate error to an experiment. Usually not all students get results that reflect the error; 5-10% get the expected 'correct' result. Students write up their results onto the board in groups and we discuss the findings. The aim is to show variation and the need for quality control mechanisms, practice/skill (one lab session does not make you an expert), and honesty with yourself. It shows the need for accuracy, objectivity and we can also explore the issues around obtaining or reporting results that don't conform to our expectations.

"I try to involve students actively and I always try to give them enough work to fully occupy them. We have some students who go fast and some who work more slowly. I organise the labs so as to have some variety and try to emulate the real-life situation where everyone is not doing the same thing at the same time. We set up four or five workbenches with a series of different tasks and students rotate around them over a number of weeks. They work in small groups and they can see what they're going to do next week or can repeat what they did last week if they have time. If there is a chance that some students will finish the main work more quickly and be bored, I have found it useful to have a side bench with additional tests where they can repeat something or try something else."

Q&A Thinking Tasks for Practical Classes

Q: I teach in a science laboratory and it frustrates me that the students mechanically follow the instructions in the manual without thinking beyond them. How do I get them to use their brains more?

A: I try and I build in thinking tasks whenever it is appropriate. I use different ones to ensure a novelty factor. Here are a few tasks to try:

Dirty tricks!
This is designed to encourage students to think critically about information. It might be a passage of text that contains incorrect statements/illogical arguments, or might be a deliberate error inserted into an experiment or task (see Iris Benzie's piece). The errors should be within reach of the students and the follow-up discussion is vital.

Flow charts
Get the students to construct a flow chart before doing an experiment, or ask them to complete a diagram from which some of the details have been omitted. Students must think about the reasons why they are using certain procedures rather than simply following procedures. For more information on flow charts, try:

Studio 1151: Flow Chart, Maricopa Centre for Learning and Instruction (MCLI)

http://www.mcli.dist.maricopa.edu/authoring/studio/guidebook/flow.html

Reflective journals
A journal is useful in any discipline for getting students to reflect on their learning and record how their understanding is changing. **The Royal Melbourne Institute of Technology** provides some questions to prompt students' thinking:

- What have I learned by doing ... ?
- How have my previous ideas/attitudes had to change?
- What is still causing me difficulties?
- What do I still need to learn?
- What connections can be made with other knowledge?

http://www.rmit.edu.au/browse;ID=elck3bf7rje51;STATUS=A

As well, students might add in their feelings, ideas, sketches or concept maps.

Formulate your own hypothesis
Ask students to formulate their own hypothesis (relevant to the topic, of course!) and then design an experiment to test it. After discussion, the hypothesis might be tested. The students' reactions as well as the results are something to watch!

Simulation
Simulation, using computer programmes, is a powerful way to engage students in practical tasks without real-life constraints. For instance, using a computer simulation, students are able to "carry out" experiments which may involve an ethnical dilemma, a high risk factor, or the use of expensive equipment. They can "administer" different drugs and observe the effects on a simulated patient. After testing and evaluating results, students can go on and experiment with alternative methods. A deep understanding can be achieved because the experiment is open-ended and less cook-book like. Commercial programmes are available but you can also seek support from EDC to develop your own.

Several ideas here have come from PolyU staff and others have been adapted from:
Bucat, R. and Shand, T. (1996) Thinking tasks in chemistry: Teaching for understanding. Department of Chemistry, The University of Western Australia.

Giving Verbal Feedback in Practical Classes

Knowing when to step in with feedback and how much to provide in practical classes can be problematic. First, students should learn through their own experience. Second, verbal feedback is very public. For high learning payoff, it is worth considering:

Timing: Unless safety is an issue, don't rush in. Look for "teachable moments" when what you say will have the most impact.

Balance: Try to praise and provide critical yet constructive feedback. Both these forms of feedback are important for students' learning.

Judgment: Sometimes feedback is best at the individual level and – on particularly sensitive issues – feedback may be better given in private if there is a risk of embarrassment. But, when appropriate, provide feedback to small working groups and the whole class because students can learn from problems that others have encountered.

Body language: On the upside, additional information comes through body language, voice tone, and facial expression. On the downside, a serious face may be misinterpreted. Pay attention to how students respond to you.

Amount: Stress the main points. Too much detail and students forget.

If you are interested in giving feedback across a variety of learning contexts, Phil Race (formerly an academic scientist, now an education and training consultant) has some useful and important things to say:

Using Feedback to Help Students Learn by **Phil Race**

http://www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=432

Online Resources

Although practical classes vary from discipline to discipline, we trust there is something in this list for everyone.

1 2 **Introducing Students to the Importance of Practical Classes.** While teachers understand the importance of practical classes, students may not. These two articles might be useful to use as a reference to write your own guide for students:

Introduction to Practical Classes by **Dr Simon Bates, Dr Hamish McLeod and Dr Velda McCune, University of Edinburgh**

http://www.tla.ed.ac.uk/services/effect-learn/practical.pdf

Getting the Most out of Lectures, Tutorials and Practicals by **Dr Lorraine Stefani, University of Strathclyde**

http://www.strath.ac.uk/Departments/BioSci/ug_ss_p.htm

3 **Subject Network** provides discipline-based support for learning and teaching, and brings together ideas and good practice from universities across the UK. Twenty-four subjects are included with the first five on the list being **A**rt Design and Media; **B**ioscience; **B**uilt Environment; **B**usiness Management and Accountancy; **E**conomics. Sampling content, there looks to be some challenging discussion and useful resources. Go to:

Subject Network at **Higher Education Academy**

http://www.heacademy.ac.uk/474.htm

4 **Teaching and Demonstrating in Laboratory Classes** is a comprehensive booklet covering topics including the aims of lab work, preparation, teaching strategies, assessment, and health and safety issues. Once you have finished reading it, hand it on to any research assistants or research students who support laboratory teaching.

Flinders University http://www.flinders.edu.au/teach/tutor/demo.pdf

5 **Humour for Chemistry Classes**

If you're teaching science (particularly chemistry) and want to put some humour into your classes then take a look at this resource.

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Chempilations has been developed for students and teachers by Dr Brendan Burkett who lectures at the School of Chemical and Physical Sciences, Victoria University of Wellington. Brendan took up this post in 2004 after spending several years as a Research Associate in the Department of Applied Biology and Chemical Technology at PolyU.

Chempilations by **Dr Brendan Burkett**

http://www.chempilations.com/home.htm

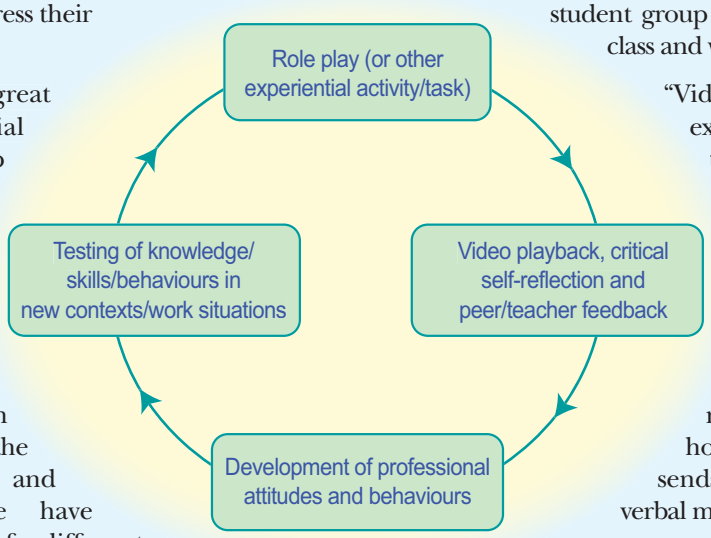
Note: All links worked at April 2005.

Using Role Play to Learn Communication Skills

Practical classes are not exclusive to the "hard" sciences where students need to learn how to use equipment and follow protocols. Students in other disciplines also benefit from practical classes although their form and function may be different.

Dr Gladys Lam works in the Department of Applied Social Sciences (APSS). Her department strongly advocates using a range of experiential learning techniques to provide a solid foundation for students who wish to progress their careers as social workers.

"We [in APSS] have great belief in experiential learning. We want to help students to be more aware of their past learning patterns, have an open mind and learn to self-criticise. We believe students learn skills by practising them and base our approach on Kolb's learning cycle. For the subject 'Communication and Self-Understanding' we have developed a range of different exercises and games to help students enhance their awareness of the values they hold.



"We believe that skills have to be learned step by step, from simple to more sophisticated. Role play is a very useful approach for developing skills. We have developed a pool of appropriate case material by asking students to generate case study situations from their own work or life experiences. We screen these case situations and then write them into a paragraph or two for role play exercises. In doing so, we think about the purposes of the social worker–client interaction, the expected performance of the social worker, the possible interactions, and the issues arising from the dialogue between the client and the worker. We do not want it to be too structured and do not want students to follow a script because they need to develop skills to handle changing situations sensitively and with consideration of the needs and problems of individual service-users.

"The role play exercises are used with small groups – one student is the client, one is the worker, one is the observer. To run the role play we usually split the class into four or five small groups, each working on a different role play situation. This gives us plenty of variety and students can learn from each other. Each student group does the role play for the class and we often videotape them.

"Videotaping the role play exercises is very important in that students are made aware of how they present themselves and how they can develop the skills they need as helping professionals. Initially students may not know that some small mannerism or gesture, or how they speak to people, sends out unintentional non-verbal messages.

"We debrief by asking students to comment on their own performance as we play the tape back. We then invite feedback from their peers before we add our own feedback. We have to be sensitive to the students, some of whom can be quite fragile. We have to be critical but also give encouragement. At the beginning some students are embarrassed to see themselves on tape and find it hard to receive feedback, but as the class progresses they are able to reflect in a more critical way and their learning attitude improves.

"Students who have taken this subject usually find teaching/learning stimulating and inspiring, and the learning environment supportive. They understand themselves better and so are better prepared to be a reflective and skillful helping professional."

Endnote

So, you've read this from cover to cover?

Well then, it must be time to ...

Thanks to ...

In this issue we would particularly like to thank Professor Iris Benzie (SN), Dr Gladys Lam (APSS) for sharing their ideas, and Dr Brendan Burkett (Victoria University of Wellington) for permission to use his cartoons.

Read "Activate" Issue 6 online at: http://edc.polyu.edu.hk/Activate/6.pdf

Further Information

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