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A Lecturer's Guide to Problem-Based and Interactive Learning

An ebook explaining how you can engage students and encourage depth of learning

1 Introduction

This ebook will introduce some important concepts that can help you change the way you think about and facilitate learning.

Experiential learning, problem-based learning and interactive learning are more than just buzzwords: they offer teaching and learning methods that can help your students master concepts faster and, more importantly, go out into the world with the ability to learn from experience, absorb and integrate new information, and continue the process for a lifetime that began in your university classroom.

That's important for your career as well. Teaching excellence is taking a higher profile in UK universities, and well it should. If you're ready to move to the next level and have a greater impact on students and their learning, read on.

"When learning is conceived as a holistic adaptive process, it provides conceptual bridges across life situations such as school and work, portraying learning as a continuous, lifelong process... learning is the process whereby knowledge is created through the transformation of experience."

David Kolb (1984)

2 Who should read this ebook?

Anyone teaching, or planning to teach, in further or higher education.

This ebook will cover:

- What are experiential, problem-based and interactive learning?
- Case studies: Experiential, problem-based and interactive learning
- Why active learning is important
- The Healy Matrix: A useful tool for curriculum analysis and design
- Ways you may already foster experiential, problem-based and interactive learning:
 - Sandwich courses and internships
 - Laboratory experiments
 - Small-group projects
 - Individual research projects, particularly those using the action research approach
 - Online interactive learning
- Creating new opportunities for experiential, problem-based and interactive learning
 - Student or professional communities of practice
 - Service-based learning
 - Activities based on the "5 Questions" model
- What's different about facilitating active learning and traditional teaching?
- Key skills for lecturers
- Activity: Blueprint for an experiential learning project
- Assessing active learning
- Back-up plans: What to do when things go wrong
- Resources for focused teaching skill development

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What are experiential, problem-based and interactive learning?

Experiential learning is based on students using prior knowledge, research and hands-on experience to explore and understand a topic of interest or relevance to them. Reflective thinking and discussion occurs throughout the experience. Although it is fundamentally learner-centred, lecturers may play a variety of roles in the process, including preparation, facilitation and assessment. Learning can be individual or group-based.

Problem-based learning is based on students, usually working in small, independent groups guided by a tutor, to solve or explore a set problem. The problem must not have a set solution: students must gather information (starting with what they already know, or think they know), theorise, conduct further research, experiment, discuss and reflect, then come to a solution that is best supported by the evidence they have found through this experience. This can occur inside or outside a classroom or lab.

Interactive learning is based on students interacting to build a knowledge base, construct theories, and test these. Although non-digital interactive learning methods like role play are often used, increasingly social networking-style interactive environments and location-specific computing tools such as smart phones, GPS and wireless web access are employed. This allows students to collaborate on and discuss learning projects together or remotely, synchronously or asynchronously.



Tip:

Sometimes a lecture format actually is the best way to work. You can build whole modules or courses around active learning paradigms, or just build it in where it makes good sense for your students and your subject.

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Active learning activates understanding

These categories are not mutually exclusive: obviously, students working together on an experiment are interacting as they solve problems through experience, and both group problem-solving and interactivity are part of experiential learning. All of these forms of learning incorporate what can be described as “active learning” techniques. Students are expected to create or co-create knowledge rather than simply receiving facts.

There is also a place within these paradigms for traditional lectures (“passive learning.”) For example, a lecture or other lecturer-centred format may be the best method to:

- Set ground rules for the planned learning experience
- Discuss how learning will be assessed
- Explain procedures or safety regulations
- Provide key facts that students will need before they proceed
- Discuss any ethical issues they may encounter
- Debrief after an experience or experiment
- Assess individual effort and results

“Students learn best when learning is active: When they are mentally involved, when they engage in hands-on activities, when they are involved in a process of inquiry, discovery, investigation, and interpretation. Thus, learning is enhanced when students repeat the information in their own words or when they give examples or make use of the information.”

Steven Mintz,
Director, Graduate School of Arts and Sciences
Teaching Center, Columbia University

5 Case studies

As you will see from the following three case studies, problem-based and interactive learning can be thought of as subsets of experiential learning. However, they each accentuate one part of the learning experience.

a Experiential learning case study

Dr Steven Mintz has pioneered the use of active, experiential learning techniques in the field of history: not just teaching students history, but teaching them to become historians. For example, in his "Coming to America, Coming to Houston" project, developed for University of Houston undergraduates, students read and evaluate accounts from a collection of literature, including first-person documents; go out into the community to collect oral histories; and then use what they have learned to create an interactive website telling the story of American immigration and its impact on their city. History students also have weekly experiences of directly researching history using an array of multimedia sources. Reflection is built into these learning experiences. (Mintz, 2014b)

b Problem-based learning case study

Dr Dee Silverthorn teaches physiology at the University of Texas, and uses problem-based learning for most key topics. Students are required to complete essential reading before class sessions – and may be tested on their mastery of key facts before problem-based work begins. Students are then set a problem, and use what they have learned - discussion with their classmates, comparing notes, asking questions - to find the solution. Silverthorn says it is important for her to be able to move around the classroom freely to talk directly to students rather than standing in front, and for students to be able to see and hear each other. Her students also use an electronic response system, so that they can suggest, vote on and feed back about ideas immediately. (Silverthorn, 2006)

c Interactive learning case study

Students at Charles Sturt University used interactive online tools to create and interact via blogging while undertaking five-week professional experience placements in schools. In this assessed activity, students posted blog entries before and during their placements, including two mini-case studies applying theory to what they had observed and experienced on the job. They were also required to comment on other students' blogs, comparing experiences, suggesting solutions to problems, and discussing theory and practice. Blogging was chosen to encourage interactive and reflective learning while the students were working off-campus. (Kennedy et al., 2009)

For another example of interactive learning, see [Top tips for promoting active learning on science and engineering courses](#)

**Tip:**

Most university teaching spaces were designed with the lecture model in mind. Think about ways you might move furniture to foster interaction in the classrooms you teach in, or consider whether other, less formal spaces might be used for active learning sessions.



6 Why active learning is important

University lecturers need to know about and incorporate active learning into our curriculum designs for many important reasons. These include:

- Moving students into applying what they learn earlier
- Fostering critical thinking
- Encouraging self-directed learning and effective group work
- Creating a classroom environment where students are more likely to be very engaged and attentive
- Giving lecturers constant opportunities to assess how well students understand what they are learning
- Making formative assessment easier and more frequent
- Helping students see how university education relates to future or current work, and to real-world issues

These learning objectives fit well in any university course, but are of critical importance when lecturers are challenged to show management evidence of improving student experience, improving student retention and progression (both of which are closely linked to student engagement), and course/programme relevance to society. They also have particular application for teaching and learning in fields where practical application of knowledge is essential, such as health sciences, computing, and professional education.

Importantly, there is clear evidence from research (see Felder and Brent, 2009, and Prince, 2004, amongst others) that active learning improves student achievement: they learn more, remember more and feel much more confident in applying what they have learned and in pursuing further independent learning.

"If a lecture or recitation session includes even a few minutes of relevant activity – a minute here, 30 seconds there – the students will be awake and with you for the remaining time in a way that never happens in a traditional lecture, and most will retain far more of what happens in those few minutes than of what you say and do in the rest of the session. If you do that in every course session, at the end of the semester you'll see evidence of high-level learning unlike anything you've seen before."

Prof. Richard Felder,

Chemical Engineering, North Carolina State University and Rebecca Brent,
President, Education Designs Inc.

7

The Healy Matrix: A useful tool for curriculum analysis and design

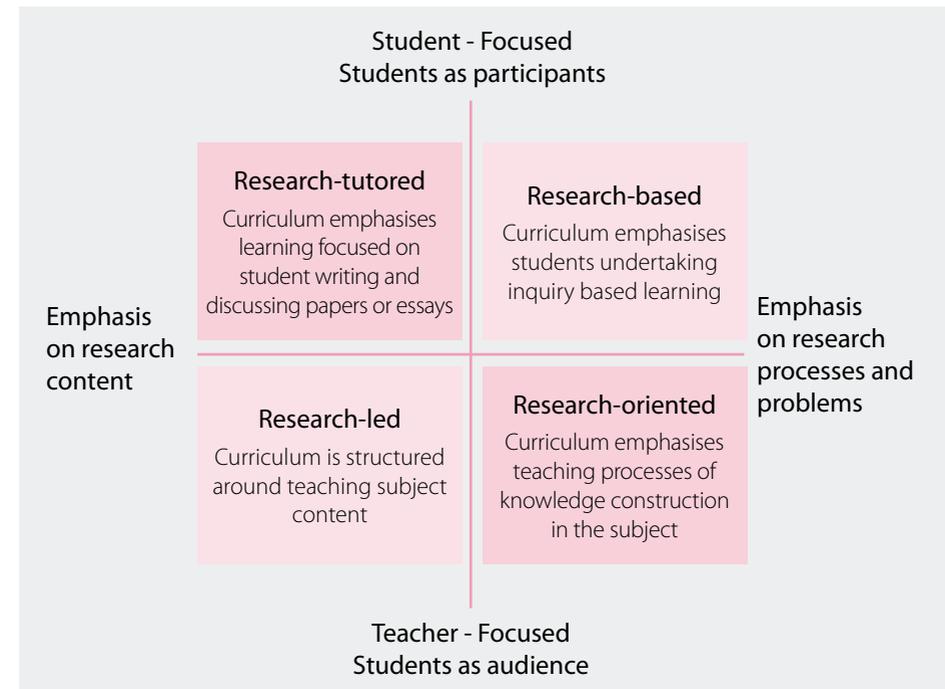


Fig. 1: Healy matrix (adapted from Healy, 2005)

Mick Healy has noted that it makes good sense for lecturers to use active learning as a way to tie together research, teaching and learning. This fulfills students' expectations that research-active lecturers and departments will provide them with an enhanced learning environment—a desire that isn't quite fulfilled by lecturers simply dropping in tidbits from their own research as they lecture. It can also enhance curriculum development in many ways, leading to vibrant classroom environments that are interesting and useful for lecturers and students alike, and more effective teaching.

Healy suggests examining the current curriculum used on your course to see where various activities and modules fall within the matrix shown in Fig. 1. All of these forms have value and may be fit for purpose, but if you want to improve student performance and understanding, moving towards more active forms that are integrated with research is a sensible goal. You could transform the curriculum entirely, and some universities have done so, but Healy notes that building inquiry-based learning into each level of a course, perhaps capping it off with an extended project at the end, is a manageable first objective.

There are many ways to construct sessions where students find out how the knowledge in textbooks and journal articles is produced. Instead of having discrete “research methods” modules where students learn techniques in isolation from practical application, build in hands-on experiences of doing research. You can use the actual sources that underlie your curriculum, or ask students to generate and work with completely new data. Possible activities include:

- Working with pre-existing data sets to produce their own analyses
- Examination of physical objects or spaces, such as archaeological collections or buildings, using current research techniques to gain new perspectives
- Conducting laboratory-based experiments and recording and analysing their own data
- Collecting data through interviews or observations and analysing results
- Deconstructing existing analyses of data through replication
- Undertaking their own research projects over a period of time, as individuals or in groups
- Working alongside staff on research projects

“Exploring and developing the disciplinary spaces in which research and teaching may be linked should be a priority.”

Mick Healy (2005)

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Ways you may already foster experiential, problem-based and interactive learning — and how to do it better

Almost all lecturers use some sort of active learning technique now and then. When you ask the class a question and hope for a response, that’s a very basic form.

However, we all know that there’s a tendency for the same students to answer every time, and most of us know that some of our questions are rhetorical in nature—we already know the “right” answer and are just waiting for someone to repeat what they have read in the text or inferred from our lecture. When lecturers set things up differently, providing information and research skills and acting only as an advisor so that students have to figure it out for themselves, we’re getting closer to the mark.

Sandwich courses and internships offer students a chance to test theories developed in the classroom in the real world, but all too often this opportunity is squandered. Frequently students spending a year in industry, carrying out [work experience](#) as part of their course, or undertaking internships are used as free administrative labour or given other repetitive, low-level tasks to perform.



If you run a sandwich course or help to place students as interns, you have the power to negotiate with employers, including building in the expectation that students will be part of project teams, have access to internal information sources and training, attend strategy and business meetings, do hands-on work with key processes, and have regular (hopefully daily) chances to reflect on their experiences.

The model used in teacher training is closer to the mark. Students work alongside an experienced professional, create and try out lesson plans, and carry out teaching and learning projects independently. They meet regularly with their university-based advisor and course cohort as well, and through this and written assignments reflect on and contextualize their experience of teaching. This process continues after initial teacher training, as Newly Qualified Teachers work under supervision and build a portfolio of reflective self-assessments.

Laboratory experiments are, obviously, a form of experiential learning—but there is a tendency to set up experiments in such a way that students simply follow a set of instructions. This can be important for teaching proper lab procedure, but it doesn't involve much actual "experimenting." If students can test theories about substances, processes or procedures in real-world environments without knowing exactly what will happen, write their own theories based on what they see, then reflect on these by comparing their findings to current knowledge and theories, they will gain a fuller understanding of how and why an experiment got a certain result.

The idea of "experimenting" has validity outside the STEM subjects as well—lecturers in social sciences and the arts can do much to encourage students to formulate and test theories. Experimentation can happen in interactions between people, on a stage, or in the community, not just in a laboratory.

**Tip:**

One way to ensure all students get the most out of group projects is to set up pre-determined roles for each group member. You can also use project diaries and peer evaluations as a way to double-check individual effort.

Small-group projects are an important part of many university degrees. Including a reflective element in which students have the freedom to critique not only the product but the process, interactions and expectations that went into it can enrich these.

Unfortunately, not all students are equally engaged by project work. There is a tendency for groups to be steered and dominated by the loudest or most ambitious student, with the rest simply pulled along in his or her wake. There is also a tendency for projects to be about creating a form (an essay, portfolio or presentation) that simply collates content created by others.

Insist that students carry out at least some original research with people, things or processes, not just text sources. Use classroom exercises and real-world examples to support students as they build skills in navigating group dynamics.

Individual research projects, particularly those using the action research approach, often involve students in creating a product (for example, a sample magazine on a Journalism course), carrying out actions in their workplace (such as experimenting with a new method of working with hearing-impaired children on a Speech Therapy course), or observing, analysing and reflecting on actions in the real world (such as an observation-based study of business processes on a Business course).

It is important that students demonstrate competence in creating high-quality outputs, whether it's a business report, a computer programme or a film. But if we also encourage them to reflect on the process of getting there, of their interactions with others along the way, and of how they developed and refined methods of working, the end result will be more valuable for the student in the long term.

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Creating new opportunities for experiential, problem-based and interactive learning

Moving towards active learning does come at a price: you'll need to make space in your teaching schedule by shortening your lectures, and you'll need to spend time preparing session plans and resources.

Using or developing student or professional communities of practice

Wenger (1999) suggests that real-world learning takes place constantly through the interaction of people who share a need or interest. We change our behaviour based on how we relate with each other and with the world, and this behaviour change is learning.

Within communities of practice, participants develop over time ways of interacting, communicating and working, stories and methods that help them make sense of information, stores of information that they can draw on, and so on. Members construct social identities based on membership and participation.

What might you do to move students towards this kind of relationship? First, help them to develop communication tools and confidence to take part. They'll need to know how to successfully communicate ideas, negotiate, mediate, strike bargains, and build consensus. Pair them with more experienced researchers (final-year students, post-grads, lecturers, professionals) so that they can learn through observation, discussion, and then small acts. As mastery grows, newcomers will become experienced and eventually mentor others.

Imagine that instead of meeting in the library to talk about homework, student-run study groups interacted with experts in their field of study online or locally, were full members alongside staff in active departmental research groups, and frequently visited or worked in places where their study subject is employed. Students would graduate with not only the basic knowledge and skills expected, but with working relationships inside and outside of academia and ways to maintain them.

Service-based learning

Service-based learning is a teaching and learning strategy that involves students in community service projects as part of their assessed coursework. This not only gives students real-world experience, it embeds the university as a centre of expertise in the wider world.

Examples of service-based learning include student-run law clinics that help the public with legal problems, health sciences students providing health education to communities, and environmental sciences students investigating local water quality and suggesting or implementing solutions.

For more ideas on service learning, see:

["Beyond the classroom: Encouraging student engagement."](#)

Activities based on the "5 Questions" model

Educators Micah Jacobsen and Mari Ruddy have developed a simple set of questions lecturers can use when students are involved in learning experiences. These questions work to encourage reflection, contextualisation, and extension of learning, no matter what field of study you work in. They are:

1. Did you notice...?
2. Why did that happen?
3. Does that happen in life?
4. Why does that happen?
5. How can you use that?

This ebook includes a worksheet for creating an active learning experience based around these questions.



10

What's different about facilitating active learning and traditional teaching?

Kolb (1984) draws on the work of Paulo Friere and others to explain the differences between experiential learning and traditional lecture formats. Friere, for example, compared traditional teaching with banking: lecturers make “deposits” of facts, that students can then draw on as needed. This method assumes that all knowledge imparted is absolute fact, should not be questioned, and will remain the same over time.

However, we know that in the real world “facts” are not so black and white: the knowledge base in every field is always developing as new findings and methods allow us to reinterpret existing data, or gather new kinds of information. Personal standpoints, culture, and changing notions of ethics and values also determine how we interpret information and experience.

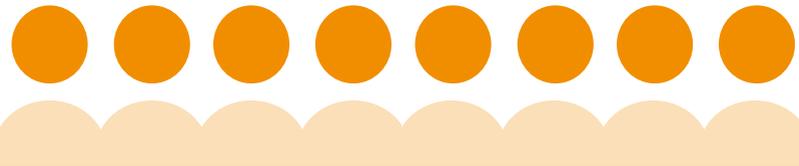
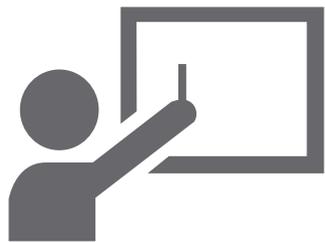
So having a head full of facts isn't enough. Learners need skills for actively searching for knowledge throughout their lives, testing it out, looking at it from different perspectives, and integrating it with what they already know.

That doesn't mean your expertise isn't needed: lecturers will remain key sources of facts, ideas about how to work, and advice on solving problems. We have to make sure students have all the information and resources they need, help them generate ideas and projects, and sort out interpersonal and individual issues.

“I created a student workbook that includes preclass reading assignments, information and figures for use in class, and lots and lots of problems. The preclass work tells the students which pages to read and includes basic content questions that are covered in the reading.”

Dr Dee Silverthorn, University of Texas (2006)

There is also an active facilitation role in which lecturers use targeted questions and well-designed processes to encourage student learning, a bit of coaching-style motivation to keep students engaged and on track, and also a place for didactic learning through provision of basic facts, discussion or demonstration. How much of each you will need to do will depend greatly on the nature of the problem or topic, and how knowledgeable and confident your students already are.



11 Key skills for lecturers

Kolb suggests that there are four key skills or attitudes needed for successful experiential learning, which correspond to four types of learning that, when combined, provide mastery of the process:

Concrete experience abilities: involving yourself completely in a new experience, setting aside personal biases in order to take in all information possible.

Reflective observation abilities: being able to look at the experience they have had from not only their own perspective, but from other perspectives as well.

Abstract conceptualisation abilities: being able to come up with workable theories based on experiences.

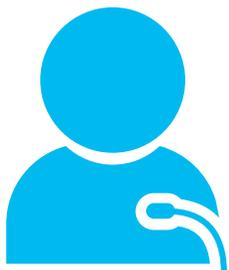
Active experimentation abilities: being able to take a theory derived from experience and use it productively to solve problems and make evidence-based decisions.

Lecturers will need to understand how these processes work, model them, and support students to find their way through these phases of learning (which occur in cycles rather than in a straight line).

Lecturers also need to become highly skilled at preparing students to work independently, supporting individual students and fostering good group dynamics. Students do not all learn at the same pace or in the same way, and will have different strengths and interests. You may need to differentiate tasks, and try different ways of presenting crucial information (text, audio, video as well as direct experience), and you will almost always have to encourage learners who are used to lecture formats and essay- or exam-based assessment to stretch.

Finally, evaluating experiential learning can be significantly different from marking exams or essays. We need to design evaluation methods that capture success from many different angles: did students participate, interact, engage others, draw on personal knowledge, access additional sources, form solid theories, and test these in a well-thought-through way? Are they able to reflect on, use and extend what they have learned? Assessment should ideally capture the full picture rather than just the view provided by a few pieces of static output, such as a reflective essay or a set of blog posts. Formative assessment can be more time-consuming.

"Experiential lessons provide students with an opportunity to experience concepts first-hand and, as such, give students a richer, more meaningful understanding of course concepts and of how they operate in the real world... they enhance the affective quality of the course content. This occurs both when students are engaged in solving problems that are part of the activities and when they are analyzing, sharing, discussing, and reflecting on their personal reactions." (Slavich and Zimbardo, 2012)



Tip:

Facilitating active learning is a bit like coaching a sports team: Students do the work and you support them by showing them ways to improve, evaluating their progress, and giving them encouragement.



12

Activity: Blueprint for an experiential learning project

Jacobsen and Ruddy's "5 questions" model for enhancing experiential learning is based around the idea of students experimenting and then being debriefed. It's important to note that this isn't necessarily an end process – debriefing might occur at intervals while a project is in action.

You can use this simple tool to make the most of experiential learning alongside your students.

First, think of a way that your students could learn by doing: this might be a lab experiment, community service project, role-play, game, group or individual practical project:

Experiential learning project idea:

Think about your idea for awhile. What resources will students need? You may need to do additional research or work to explore the possibilities. If possible, involve students themselves in this process.

Resources required:

(spaces, tools/equipment, information, instruction, permissions, funding, etc.)

Now consider when debriefing should optimally occur during the activity: are there key points where it would be especially important for students to reflect on their practice before moving on? Is there a need for a final debriefing?

What other actions do you and your students need to take before, during and after the activity?

Project plan (including elements like preparation, debriefing, assessment)

Work alongside your students as they immerse themselves in the activity, whether that's in a classroom, a workplace, the community or virtually. Online tools like WebCT/Blackboard, Moodle, wikis or even Facebook groups can be used to encourage communication when students are working off-campus.

At planned intervals, based on what you expect based on prior knowledge and what actually occurs during the activity, pause to ask students about their experiences:

1. Did you notice...?
2. Why did that happen?
3. Does that happen in life? (or, if it's a real-life activity, Does that happen typically or in other situations/workplaces?)
4. Why does that happen?
5. How can you use that?

Encourage students to use these questions informally as well, individually and within work groups.

Collate the answers and feed them back, enhanced with your own analysis based on experience and knowledge. Encourage students to see that their experiences are generating knowledge.

13 Assessing active learning

Active learning isn't easy to measure through the usual end-of-term essay or test. Formative assessment is more useful, with multiple components. Methods you might try include:

- Pre- and post-tests to ensure students do the basic reading and have mastered key concepts. Pre-tests can also help lecturers respond quickly to any deficits
- Planning documents submitted before a activity, such as a game, role-play or experiment, takes place
- Oral debriefings (a bit like a viva) where students answer individualised questions about how they or their group carried out tasks, negotiated issues and solved problems
- Process diaries
- Self-assessment and peer-assessment
- Multiple short essays describing and analysing key parts of the active learning process
- Observation while students are working (this can include observing online interactions, for example)
- Portfolio assessment, with the portfolio comprised of both final results and other elements that are more concerned with the learning process

Some lecturers use assessment as a way to encourage participation, for example requiring students to critique each others' ideas or exhibit minimum levels of participation in online forums or within work groups.

Tip:

It's often useful to cross-check self-assessment and peer-assessment, and address issues that may impact student success. Often students are unaware of habits or traits (such as inability to compromise, tendency to dominate or disappear in a group, or poor listening skills) that impede learning. Unfortunately, a few will also present self-aggrandising or fictional accounts of their participation, and comparison with peer accounts will usually reveal this.



14 Back-up plans: What to do when things go wrong

Sometimes lecturers will find that their students lack the basic knowledge or research skills required to carry out successful experiential learning. When this happens, you may need to provide more instructions or extra source material, demonstrate key processes, or become more involved in direct work alongside students.

Another problem is that many students expect didactic learning at university (and this is especially true for overseas students coming from countries where chalk-and-talk, top-down lectures are still the norm for teaching). Student attitude can have a massive impact on the success of experiential learning.

If you observe problems—disengaged students, complaints—back up and provide practical examples of how experiential learning will take place in their future work. Try to elicit examples from students from their own real lives. How did they learn to play computer games, ride a bike, or do their current job? Chances are that most can see how they have learned from experience as well as from manuals, books and formal instruction. You may also want to point them towards the research literature on active learning.



Tip:

If your own university has a teaching and learning centre, make contact—you may have active learning experts quite close to home!



15 Resources for focused teaching skill development

Experience Based Learning Systems Inc.: learningfromexperience.com

Further development of the work of David Kolb and others, including many online resources

Higher Education Academy resources:

- Active and experiential learning in the Social Sciences: www.heacademy.ac.uk/resources/detail/disciplines/Soc_Sci/Strategic_2013/ActiveandExperiential
- Experiential Learning: www.heacademy.ac.uk/hlst/resources/a-zdirectory/experiential_learning

The Interdisciplinary Journal of Problem-Based Learning: docs.lib.purdue.edu/ijpb/

Jacobson, M. and Ruddy, M. (2004) Open to Outcome: A Practical Guide for Facilitating and Teaching Experiential Reflection. Bethany, OK: Wood 'N' Barnes.

Kolb, D.A. (1984) Experiential Learning: Experience as the Source of Learning and Development. New Jersey: Prentice-Hall.

Joseph Jay Williams: www.josephjaywilliams.com/education

Many resources focusing on research or problem-based learning, including its use in MOOCs and distance education.

University of Minnesota Centre for Teaching and Learning tutorial series – "Making Active Learning Work":

www1.umn.edu/ohr/teachlearn/tutorials/active/what/index.html

[The Essential Guide to Moving Up the Academic Career Ladder](#)

[12-key-lecturing-skills-ebook/](#)

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17 About the author

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